THE RHODESIA

# Agricultural Journal.

*Edited by the Director of Agriculture*
*(Assisted by the Staff of the Agricultural Department).*

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## EDITORIAL.

*Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.*

**Export of Meat.**—The export of meat to the United Kingdom has been brought a stage nearer by the organisation of the Cattle Owners' Association.

Hitherto, the only overseas market of importance for our beef has been the Italian Army contract. While this market offers an opening for a considerable number of cattle —20,000 to 30,000 at present—it is not sufficiently secure nor large enough to absorb the surplus of cattle accumulating in the Colony. It is anticipated, therefore, that the efforts of the Association to get in touch with the Smithfield market will be of much value to the Colony.

The United Kingdom absorbs about two-thirds of the frozen beef moving into international trade, importing in 1930 one and three-quarter million cwt. of frozen beef and approximately a similar quantity of canned meat and frozen entrails. There should be an opening on this amount for

all the frozen beef Rhodesia can produce until such time as the quality of our cattle has been improved sufficiently to make the export of chilled meat practicable on an economic scale.

The preliminary trial exports which have been planned will not take many head of cattle out of the country, but they will serve to bring Rhodesian beef to the notice of the chief world market and give producers in this Colony some experience in the requirements of the meat trade. This experience will be of great value when the present veterinary restrictions on export are removed.

The present intention is to export this meat via Beira, making use of the one Lightfoot-Stone refrigerator truck now available. This truck has a capacity of about 13 tons of frozen meat. Eight similar trucks have been ordered, which should be in commission by the end of this year, giving a capacity of 100-120 tons of frozen meat per train load. This meat will be loaded from the trucks direct on to the boat, or held at a low temperature in the trucks at Beira if the ship is not ready. Unfortunately no suitable cold storage is available at Beira to store the meat.

As a beginning it is planned to send a trial shipment of 10 tons of "vealers" to Smithfield. These so-called "vealers" are in reality something between "brown veal" and "baby beef," and the shipment has been planned to test the reaction of the market to this type of meat. The calves will be shipped on commission by the Rhodesia Cold Storage and Supply Company, and any loss or profit will be borne by the breeders co-operating in this experiment.

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**Locusts.**—In our March issue we published a warning regarding a possible invasion of the Colony by the red locust. At that time there was a distinct danger of swarms originating from the Fesheke district in Northern Rhodesia flying south into Matabeleland. Later news is more reassuring. Recent reports from Northern Rhodesia indicate that these locusts have flown in a south-westerly direction into the Caprivi Strip and Northern Bechuanaland. This direction of flight is particularly interesting, as swarms of this species of locust

have maintained a steady south-westerly direction of flight ever since they crossed over into Northern Rhodesia from the Belgian Congo in 1930. Other flying swarms bred out from eggs deposited in the Kafue Flats have turned north.

Flying swarms of both the European locust and the red locust are present in neighbouring territories on the north, south and west, and an invasion may possibly occur later in the year. Fortunately the main crops are now too far advanced to suffer serious damage in the event of an invasion occurring within the next few weeks.

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**Tobacco Research.**—About a year ago Dr. C. W. B. Arnold, who is in charge of the Imperial Tobacco Company's Experiment Stations in Nyasaland, visited Salisbury and assisted in laying down the programme for tobacco research to be undertaken on the Salisbury Station.

In Nyasaland he is investigating the tobacco problem chiefly from the chemical standpoint, and it was decided that we should devote our attention more especially to the cultural and plant breeding aspects.

Dr. Arnold has been paying particular attention to the chemical composition of cured tobacco leaf, to account for, if possible, the difference in burning quality, flavour and aroma which is known to exist between tobacco grown in Nyasaland or Southern Rhodesia and American grown leaf.

Numerous analyses of leaf tobacco have shown that, by comparison with American leaf, African grown tobaccos contain a much smaller percentage of chlorine. A portion of the chlorine in tobacco is vaporised during smoking, but the major portion is retained in the ash. From an analysis of cigarette grades of American leaf the percentage of chlorine found in the ash varied from 5 to 12 per cent. The comparative figures for Rhodesian leaf are only 1.1 to 1.9 per cent.

Dr. Arnold found that under greenhouse conditions it was possible to introduce chlorine into Nyasaland leaf by the application of muriate of potash and common salt. In some cases it was shown that from 5 to 10 per cent. additional

chlorine remained in the ash when the tobacco had been fertilised in this way. Under field conditions, however, it was found that the amount was considerably less and it was considered probable that the difference was due to the leaching effect of heavy rains.

When the above tests were made it was impossible to ascertain from the literature the origin of the chlorine in the American leaf, since none of the published analyses of American soils showed an unusual amount of chlorine. To enable this point to be decided the Imperial Tobacco Company obtained samples from six well-known tobacco districts in America for analysis, and it was found that the chlorine content was very similar to that which had been shown by analysis to be usual in Nyasaland and in Southern Rhodesia. Since the chlorine content of the leaf could not be accounted for by the soil, the company obtained six samples of the commercial tobacco fertilisers in general use in the United States of America, and the analysis showed that they all contained chlorine in amounts up to 3 per cent.

The tobacco fertilisers used in the United States of America have generally been bulky, organic mixtures which are known to contain a higher percentage of chlorides than is found in the high-grade fertilisers which are generally employed in Africa in order to save transport charges. It would therefore appear that the origin of the additional chlorine found in American tobacco is in the low-grade fertilisers which are used.

In a report of investigations on the fertiliser treatment of tobacco under American conditions, published in the Journal of Agricultural Research in 1930, it was suggested that chlorine actually improved the market value of tobacco, and that the maximum benefit was derived by applications of from 20 to 30 lbs. per acre. Muriate of potash (95 per cent.) contains 45 per cent. of chlorine, and common salt of the grade commonly used in this country contains 56 per cent. of chlorine.

Dr. Arnold suggests that even a higher dressing than that suggested in the bulletin referred to would be necessary with our rainfall conditions to produce similar effects to those obtained in American leaf, and his field experiments showed

that the yield per acre was not reduced by the application of even 50 lbs. of chlorine per acre nor was the valuation lowered. He has not been able to complete experiments on flue-cured tobacco which could be tested when made into cigarettes, but experimental plots receiving varying amounts of chlorine in the fertiliser used were planted this last season on the Salisbury Tobacco Research Station. Arrangements will be made to have representative samples from these plots submitted separately for detailed reports regarding manufacturing, burning and smoking quality, etc. These are points of great importance and it is hoped to be able to make more definite recommendations regarding the application of chlorine based on the results obtained before the next planting season.

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**A Ration for Poultry.**—During the last few years experiments have been carried out on the Salisbury station to determine a suitable economic ration for rearing heavy and light breeds of poultry from hatching to maturity.

The following has given such satisfactory results that it is now recommended by the Poultry Section for gener adoption.

For a grain mixture, it is suggested that munga m be fed alone from the time of hatching until the chicks a eight weeks old, thereafter six parts of crushed mealies shou be added to every four parts of munga.

For the mash mixture—

| | |
|---|---|
| Mealie meal ... ... ... ... ... ... ... | 45 lbs. |
| Bran ... ... ... ... ... ... ... ... ... ... | 10 lbs. |
| Pollard ... ... ... ... ... ... ... ... ... | 17 lbs. |
| Oats (rolled or meal) ... ... ... ... ... | 10 lbs. |
| Monkey nut cake ... ... ... ... ... ... | 10 lbs. |
| Bone meal ... ... ... ... ... ... ... ... | 2 lbs. |
| Limestone or powdered oyster shell ... ... ... ... ... ... ... ... | 1 lb. |
| Charcoal ... ... ... ... ... ... ... ... | 1 lb. |
| Fine salt ... ... ... ... ... ... ... ... | ½ lb. |

are mixed together. For the first three months it is desirable to add about eight per cent. blood meal or meat meal unless

thick separated milk is available, when this may be reduced to five per cent.

An ample supply of finely chopped green food should always be available, as is also the case with grit, oyster shell and charcoal. These are most economically supplied in hoppers.

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**Tung Oil.**—The use of tung oil has become so firmly established in the paint and varnish industry that during the last ten years or so attempts have been made to grow this tree in many parts of the world. At the present time the only source of commercial supplies is China, from which over 69,000 tons were exported in 1930. Thousands of acres have been planted out in America—which is the largest consumer at present—mostly in the Mississippi Valley and Northern Florida. On the whole, the yield of fruit in the southern States has not come up to expectations, and it is feared that the late spring frosts which often occur when the trees are in blossom account for the poor yields which have so far been experienced.

During the last four years the Imperial Institute, with the assistance of the Royal Botanic Gardens, Kew, has been endeavouring to get experimental plantings made in different parts of the Empire. Nearly four tons of seed of *Aleurites fordii* have been distributed, and trials are now in progress in Australia, New Zealand, New Guinea, India, Ceylon, Mauritius, the Union of South Africa, Kenya, Tanganyika, Nyasaland, and several other Colonies.

In all these places the cultivation is still in the experimental stage, and in no case has it yet been established that trees on a commercial scale will prove remunerative.

In India the principal trials are being conducted in Burma and Assam. On one estate an attempt has been made to plant 1,200 acres, and in 1930 some 35,000 seedlings were raised.

In Ceylon it is apparently accepted that *Aleurites fordii* will not flourish, but *A. montana* on the other hand appears to grow well.

In Australia a company has been formed which proposes to establish a 1,000-acre plantation at Sydney, and experimental trials in Queensland seem to indicate that *A. fordii* can be grown commercially there.

In New Zealand no less than five public companies have been formed to develop the tung oil industry with a total nominal capital of £780,000, and at several centres areas up to 500 acres in a block have been prepared for planting.

In the Union of South Africa results with *A. fordii* have not been uniformly satisfactory.

Trials made in other parts of the Empire have not been uniformly encouraging, and it has been suggested that failure is often due in the case of *A. fordii* to the absence of a proper dormant seasou, which appears to be essential for that particular species.

The cultivation of the tung oil tree is also being attempted in several of the South American States. It is estimated that at the end of last year in one centre of the Argentine over 56,000 trees were being grown, while in Paraguay there are about 30,000 trees, generally in small plantings of from 25 to 500 each.

Several questions arise at the present time in connection with attempts to establish tung oil trees in new areas with the object of achieving the production of oil on a commercial scale.

It appears that *A. montana* will flourish in districts where *A. fordii* will not, and an authoritative opinion on the relative merits of the oil obtained from these two species would be of great interest. From the tests which have already been made it would seem that the real tung oil which is derived from *A. fordii* has a greater commercial value than that obtained from *A. montana,* which is known in China as Mu-Yu oil.

The influence of the increased production on the price of oil is another point of importance to those who are contemplating planting trees on a commercial scale. During the recent general depression the price dropped from £69 10s. per ton in January, 1930, to £37 10s. in September, 1931. This can be accounted for entirely by the general depression

of prices for all commodities, and it is considered that tung oil will always command a price at least £10 above that of linseed oil on account of its special properties, which are now considered essential in the manufacture of certain types of paints and varnishes. If greater quantities were available there is no doubt that the present list of uses could be considerably enlarged.

A potential new use for the oil is in the linoleum industry, where it is estimated that tung oil could be used to great advantage in place of linseed oil. Should that be the case, the present British demand would be practically doubled, as the linoleum industry in the United Kingdom alone uses some 50,000 tons of linseed oil annually.

## HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

# REPORT OF THE DIVISION OF IRRIGATION

## FOR THE YEAR ENDED 31ST DECEMBER, 1931.

By C. L. Robertson, B.Sc., A.M.I.C.E.

Unfortunately the steady progress of the work of the Division recorded in previous reports was not maintained during the year under review, owing to the prevailing abnormal depression, forcing farmers and others to considerably restrict development and be chary of embarking on any new schemes.

It is worthy of note, however, that the demand for advice in soil erosion protection works and for the services of the Government boring machines has been practically maintained at the high level reached in the previous year, and is a cheering indication that farmers still have faith in the future of the industry in this Colony.

The general restriction of credit resulted in only one grant from the Irrigation Loan Fund being approved, although there were the usual number of applications.

The general need for economy resulted in instructions being received for no further investigations to be undertaken by the Reconnaissance Survey Party after completion of the survey of the Popotekwe Project, and it is unlikely that it will be possible to maintain this party in the field during the coming year. This is regrettable, as it is only the early and complete investigation of these larger projects which will enable sound development to be undertaken at a later date.

The investigation work of the party is bearing fruit, as it is probable that the construction of three flood storage schemes of fair magnitude in Matabeleland will be undertaken during next year.

As usual the work of the Division has been of an extremely varied nature.

The summary below gives the approximate expenditure controlled and administered by this Division, together with the estimate of cost of works advised upon during the calendar year, exclusive of ordinary advisory work.

SUMMARY.

| | |
|---|---|
| General boring operations ... ... ... ... ... ... ... ... ... | £12,510 |
| Development and installation water supplies in native reserves ... ... ... ... ... ... ... ... ... ... ... | 11,235 |
| Installation water supplies, Government institutions and townships ... ... ... ... ... ... ... ... ... ... ... | 5,550 |
| Surveys and estimates for water supplies, Government institutions and townships ... ... ... ... ... | 8,200 |
| Engineering works for Agricultural Department | 3,350 |
| Advances approved from Irrigation Loan Funds ... | 100 |
| Conservation works, native reserves ... ... ... ... ... | 600 |
| Surveys and estimates, conservation works, native reserves ... ... ... ... ... ... ... ... ... ... ... ... ... | 1,100 |
| Meteorology and hydrology ... ... ... ... ... ... ... | 850 |
| Reconnaissance survey ... ... ... ... ... ... ... ... ... ... | 1,000 |
| | £44,495 |

**General.**—The following summary shows the number of visits paid to farmers and others in connection with irrigation, soil erosion, water supplies and general engineering:—

| | |
|---|---|
| Farm visits in connection with irrigation ... ... ... ... | 102 |
| Farm visits in connection with soil erosion ... ... ... | 129 |
| Visits townships and Government institutions ... ... | 75 |
| | 306 |

| | |
|---|---|
| Acreage of new irrigable land investigated ... ... ... | 4,865 |
| Total acreage of irrigable land investigated to end of 1931 ... ... ... ... ... ... ... ... ... ... ... ... ... ... | 55,063 |

The above acreage of irrigable lands includes 3,000 acres under the *Umshandige Project*, which was investigated by the Reconnaissance Survey Party in 1930, but not previously included, as the exact acreage irrigable was not determined.

Two farmers' association meetings were attended and addresses delivered on soil erosion. Twelve lectures in agricultural engineering were delivered to the pupils at the Matopo Agricultural School.

The construction of residences and farm buildings at the Sand Veld Experiment and Pasture Research Station, together with the provision of a water supply to the various paddocks, was supervised. The construction of the furrow in the Mutema Reserve was continued, but unfortunately the early onset of heavy rains this season delayed its completion.

In addition, two weirs for the conservation of water were completed in two of the Southern Matabeleland reserves, where boring has failed to develop useful supplies. The funds for the construction of the furrow and the weirs were provided from Native Reserve Trust Funds.

Surveys and estimates were prepared in connection with nine water supply schemes for small townships and Government institutions, six of these schemes being completed during the year, viz., those supplying Chipinga School Hostel, Gomohura Leper Settlement, Selukwe Government Institution, Plumtree School, Fort Usher and Bembesi Police Camps. The water supply scheme serving Bindura township was completed, and surveys and estimates were prepared in connection with water supply schemes for Selukwe and Shabani townships. Advice was also given to Gwelo Municipality regarding their proposed water supply scheme.

The number of visits paid this year on all matters falling within the scope of the Division is 306, a decrease of 102 below the previous year's total, but practically identical with the total for 1929. This decrease is partly due to farmers restricting development owing to the difficult financial position, and partly due to shortage of staff owing to the Irrigation Engineer (Matabeleland) being on long leave.

The number of visits paid for soil erosion advice also shows a small decrease, but the amount of work performed is very much greater, as is shown in a summary given later.

Investigations were carried out during the year by members of the Division in fuel consumption of petrol-alcohol mixtures in motor car engines and on the Macdonald

High-Speed Producer Gas Attachment for use on tractors and motor vehicles. The results of these investigations were published in separate reports.

At the request of the Beira, Mashonaland and Rhodesia Railways a special visit was made to the Deka Falls railway deviation, and advice was given on matters relating to the provision of water for railway purposes along the route.

Irrigation research plots were laid out at the Matopos School of Agriculture with the object of determining the effect of various applications of water on the yields of lucerne, wheat and mixed pastures, and it is intended to commence observations there next season. This is a subject of investigation which has been long overdue, as no exact date is available for the water duty requirements of these crops under local conditions.

***Irrigation Reconnaissance Survey.***—The survey party carried out field work from the beginning of May until the end of October in connection with the Popotekwe Gorge Project in the Victoria district, the Umgusa Scheme in Bulawayo district and a small individual scheme on Southill Ranch in the Gwanda district.

The work carried out on the Popotekwe Project consisted of a detailed survey of the gorge, tacheometric survey of high and low level canal routes on both banks and demarcation of suitable irrigable land. Levels were run for a distance of 90 miles for the various routes on both banks, and a detailed band survey made for canal location on a distance of 52 miles allocated as under, together with approximate irrigable area.

| | Irrigable area. Acres. |
|---|---|
| Low level canal, right bank (18 miles) ... ... ... ... | 2,800 |
| High level canal, right bank (13 miles) ... ... ... | 3,200 |
| High level canal, left bank (21 miles) ... ... ... ... | 1,000 |

The low level canal is 40 feet and the high level canals 70 feet above river bed level at the gorge. The storage capacity of the reservoir basin has not yet been accurately determined, but preliminary calculations show that there is practically no storage below 40 feet; at 70 feet the storage is 17,000 acre feet, which is increased to 30,000 acre feet at 80 feet, with very considerable increase in storage above this level.

Owing to the extent of the catchment (413 square miles), the minimum run off in a year of low rainfall will probably not be less than 12,000 acre feet, and would be over 26,000 acre feet in the great majority of years.

As a scheme for development in the near future it is obvious that a dam 70 feet in height would suffice to provide storage for the irrigation of 2,800 acres, under the low level canal on the right bank only.

The site, however, is such a favourable one for the construction of a large storage dam to conserve the surplus storm water available in years of heavy rainfall that the survey was extended to obtain data as to the storage available at higher levels. The construction of a dam 100 feet in height would enable water to be passed down the river for the irrigation of land in the semi-arid areas of the low veld, and, by the development of power, permit of water being pumped into the high level canals for the irrigation of land in the immediate vicinity of the dam site.

When the data from the survey are reduced and plotted this matter will be investigated in more detail.

After survey of this project was completed in September a rough preliminary reconnaissance survey was carried out on the Umgusa Project, which revealed that a dam could be constructed to store sufficient water for the irrigation of 220 acres at a cost of £6,000. As this scheme is situated in the near vicinity of Bulawayo it is possible that this scheme may be constructed in the near future.

In addition, a survey was made of a small storage scheme on Southill Ranch, Gwanda, which would suffice for the irrigation of 40 acres of land at a cost of £1,300. It is probable that this scheme will be constructed next year.

As previously mentioned, it has been decided to discontinue the field operations of this party next year owing to the urgent need for economy, but I wish to place on record my appreciation of the excellent work carried out by the members of this party during the 2½ years they have been in operation.

The necessity for the early and thorough investigations of this nature is not commonly recognised, and in this connection the following remarks by John W. How, Director

of Agriculture, Northern Pacific Railway Company, are of value:—

"There is widespread failure to realise among our own people that the premises in a decision to expand or not to expand irrigated lands are not reposed in conditions now existing, but rather they are those which will obtain many years hence when the new projects now contemplated are constructed, settled and have come into production. Proposed projects, particularly the large difficult ones, require many years for completion of surveys, economic and engineering, for construction of works and additional years for securing sound settlement."

**Irrigation.**—The number of new small irrigation schemes advised on favourably during the year have totalled 40, with a potential irrigable area of 1,865 acres, and the Umshandige Project with an irrigable area of 3,000 acres. It is encouraging to note that there has been a distinct advance in irrigation development in Matabeleland during last year, as the following remarks by the Irrigation Engineer show:—

"The visits to private applicants resulted in the construction of one weir for conservation of water for stock purposes, one small masonry dam to irrigate land and the projected construction of four schemes capable of irrigating a total acreage of 105 acres. Of these four latter schemes, one of 20 acres is definitely proceeding to construction, whilst the remainder for 50, 20 and 15 acres respectively will almost certainly be constructed."

From information supplied by the Government Statistician it appears that the area under winter crops (mainly irrigated) in 1930 again showed an increase over that recorded in the previous years, the totals being 13,990 acres and 11,760 acres respectively, i.e., an increase of 19 per cent. The area under wheat again showed a very marked increase of 50 per cent. over the previous year, viz., 4,600 acres to 6,910 acres, but the average yield unfortunately had decreased from 2.8 to 2.3 bags per acre, owing to a considerable portion of the crop being grown in vlei lands without irrigation.

**In the last two years the area under wheat has been more than doubled, having increased from 3,300 acres to 6,910 acres.**

The value of wheat and wheaten products imported during the year stood at the high figure of £96,309, of which £38,817 was re-exported.

The area under winter potatoes was practically the same as in the previous year, viz., 870 acres, as compared with 900 acres, and the average yield was maintained at 20.5 bags per acre. The declared value of the potatoes imported was only £12,268, showing a sharp decline from the previous year's figure of £23,873, but the decline was mainly due to the lower value of the product, as the declared value per bag in 1930 was only 8s. 7d., as compared with 13s. 4d. in the previous year.

The area under lucerne was practically stationary at 240 acres.

Considerable development was made on the Sabi-Tanganda Estate during the year, and an additional grant was obtained for the irrigation of a further 600 acres. In this area of low rainfall summer crops are being grown under irrigation, and it is intended shortly to have over 1,000 acres under cultivation.

**Soil Erosion.**—The number of applications for advice on this subject shows a slight decrease over those dealt with in the previous year, but the amount of work actually carried out has been steadily increasing, as the following summary shows:—

| Year. | Miles of contour ridges pegged. | Area of land protected. |
|---|---|---|
| 1929 ... ... ... ... ... | 76 | 2,280 |
| 1930 ... ... ... ... ... | 103 | 3,100 |
| 1931 ... ... ... ... ... | 150 | 4,500 |

Although these figures are encouraging it will be realised that the rate of progression is still too slow when it is considered that there are over 200,000 acres under summer crops in this Colony and that a considerable percentage of this requires protection. Contour ridges were set out on three farms in Matabeleland during the year, so that it is evident that the need for this form of protection is being realised in all parts of the Colony.

The Executive of the Rhodesia Agricultural Union has appointed a special sub-committee to deal with soil erosion

policy, and will co-operate with officials in the various Government Departments concerned and with the railways, in order to obtain some measure of co-ordination on this vital matter.

This is a distinct advance in the right direction, and the results of the committee's action will be awaited with interest.

**Weirs on Native Reserves, etc.**—A commencement was made during the year with the construction of weirs for the conservation of surface water in native reserves and native purchase areas. Two weirs were constructed on Raditladi's and Semokwe Reserves, and one weir on the Insiza native purchase area.

The weirs are intended to supplement the existing policy of the development of water supplies by means of boring, and are located in areas where boring has failed to develop adequate supplies. An extension of this policy is, however, necessary, and would result in the general improvement of underground supplies in the reserves.

**Boring.**—The number of drills in the field was the same as in the previous year, but two drills were temporarily taken out of commission late in the year owing to the restrictions on movements of cattle making it too expensive to transport them from the remote areas in which they were operating.

In addition, three drills were refitted in the field and were temporarily out of commission for periods varying from a month to six weeks, and time was occupied in shifting five other drills long distances to new areas. Making allowances for these facts, the strength was equivalent to 9½ drills working for a complete year.

The summary of footage drilled, cost per foot and aggregate yield of water supplies developed is as under:—

Total depth drilled, 15,967 feet; footage drilled per working month per drill, 140.1 feet; number of boreholes sunk, 116; average depth per borehole, 137.6 feet; average charge (all boreholes), including casing and depreciation in plant, 21s. 7d. per foot; aggregate yield of successful boreholes, 823,600 gallons per 24 hours; percentage of successful boreholes, 60.3 per cent.

In the following detailed summary is shown the cost of drilling for private applicants, Government institutions, native reserves, etc.

In the case of private applicants, transport, labour and fuel are supplied by the applicant, but in other cases these are supplied by the Government, and the cost of these services, together with depreciation on the plant, included in the boring costs.

| | Private Applicants. | Government Institutions | Native Reserves. | Native Purchase Areas. | Railways. |
|---|---|---|---|---|---|
| Total depth drilled, feet. | 4,982 | 1,337 | 6,403 | 2,428 | 817 |
| No. of drill months. | 32 | 8 | 42 | 27 | 5 |
| Footage drilled per working month per drill. | 155.7 | 167.1 | 152.5 | 90.0 | 163.4 |
| No. of boreholes sunk | 39 | 11 | 39 | 21 | 6 |
| Average depth per borehole, feet. | 127.8 | 121.5 | 164.2 | 115.6 | 136.2 |
| Average cost per foot, including casing. | 18/- | 24/7 | 21/11 | 25/4 | 24/1 |
| Percentage of successful boreholes. | 71.8 | 36.4 | 56.4 | 52.4 | 66.6 |

It has, unfortunately, not been possible to maintain the higher standard attained in the previous year and the footage drilled has decreased, with a consequent increase in the cost per foot drilled.

The reasons for this are the reconditioning of three plants and the time and expense involved in shifting five drills to new areas. When these facts are taken into consideration the increase of 1s. 7d. per foot in the general drilling costs is extremely satisfactory, as it includes the cost of two new boilers, a new frame, all transport charges and a balance of £1,154 available for depreciation.

The costs to private applicants show an increase of 3s. 3d. on the previous year's figure, owing to the more difficult formations drilled in and the scattered nature of the work.

The present year's figure of 18s. per foot is, however, practically the average cost, as during the last seven years 25,546 feet have been drilled for private applicants at an average cost of 17s. 10d. per foot.

**Water Supplies: Native Reserves.**—In addition to the water boring operations and weir construction in the native reserves, windmills, tanks and troughs have been installed at a number of the permanent supplies developed in the various reserves.

Twenty-two complete installations have been erected at an average cost of £150 apiece, and three complete installations are in hand for erection next season.

**Meteorology.**—The work of the meteorological and hydrographic offices is directly supervised by the Hydrographic Engineer.

The change in the number of reporting stations was as under during the year:—

| | Number 31.12.30. | Number 31.12.31. |
|---|---|---|
| Stations with automatic instruments | 2 | 3 |
| Barometric ... ... ... ... ... ... ... ... | 12 | 10 |
| Thermometric ... ... ... ... ... ... ... | 54 | 35 |
| Rainfall ... ... ... ... ... ... ... ... ... | 530 | 532 |
| | 598 | 580 |

A number of stations have been closed down owing to the farms occupied having been temporarily abandoned.

The reduction in the number of thermometric stations is due to the defined policy of only obtaining returns from such stations as can report daily by telegraph.

These daily records are closely examined and compared and doubtful readings challenged, thus resulting in a distinct improvement in the accuracy of the records. It was found that records obtained from the stations over which this control could not be exercised were of little value. Rain gauges are now being issued through the Native Development Department to native instructors in the reserves.

If this experiment proves successful it may be possible to dispose of a number of gauges in areas from which no information is at present available.

Bulawayo Observatory was taken over completely and equipped with a range of recording instruments and a trained observer has been in charge since 1st March.

Mount Nuzi at Stapleford has been equipped with recording instruments and useful information is being collected. We are indebted to the Forestry Division for the running of this station.

It was hoped that it would be possible to equip a number of stations with thermographs this year, but the instruments arrived too late in the season.

**Weather Forecasting.**—An investigation of the detailed daily maps of last season has indicated that a considerable amount of our rainfall is due to travelling disturbances. The new International Code was introduced in October and a figure included to indicate the time of rain; this has proved useful in investigating and forecasting "fronts." The new code is more cumbersome than the old and the cloud observations are beyond our present observers. A strict comparison of the weather at neighbouring stations has led to the subdivision of the map into ten forecast areas. Forecasts are now issued specially for each area and are stated in terms of probability of rain at any point instead of the old system of area forecasts.

**Aviation Meteorology.**—It has been necessary to reorganise the office and staff to meet the demands of aircraft. An officer has been stationed at Bulawayo to run the Observatory and to receive weather reports.

One additional man has been appointed at Salisbury. This has made it possible for one official to concentrate on weather maps and forecasting. The organisation for weather reports has been completed and full reports and forecasts were supplied to the first aeroplane in December.

**Information Published.**—

(a) Annual Report.

(b) Monthly Weather Report in the *Agricultural Journal.*

(c) Weekly Summary of Rainfall.

(d) A daily weather report and forecast during the rainy season.

(e) Daily records of meteorological elements from five stations were forwarded monthly to London.

(f) Summaries of rainfall are forwarded to Poona and Rio de Janeiro.

(g) Mr. Peake contributed a paper to the South African Association for the Advancement of Science on the daily rainfall at Salisbury and Bulawayo.

**Aneroid Levels.**—A number of enquiries about the use of aneroids were answered and the Kalahari Survey Party was loaned certain instruments. The levels of the main points on the Kalahari Survey were determined in this office.

**Hydrography.**—The routine work of this section comprises the collection of data relating to storm and winter flow conditions of the chief rivers of the Colony.

The information is obtained by means of:—

(1) Automatic recording instruments at gauging weirs and dams.

(2) Individual gaugings by members of the engineering staff while on tour.

A gauging instrument was erected on the Umshandige River in connection with the survey recently completed there. One station at Glengrey was closed and the number of stations remains as before—13.

Complete records have been calculated for four stations and will be available for publication in this year's report.

**Water Ordinance.**—The writer, or the Hydrographic Engineer as alternate, sat as engineering assessor on four water courts during the year, one of which was a special court to deal with an application from the Gwelo Municipality.

In all, 44 applications were dealt with, of which ten were for mining purposes, one for town water supply and one for railway purposes, the remainder being for irrigation. Three of the applications were refused, so that in all 29

irrigation schemes were approved, for which authority was sought to irrigate 1,490 acres, and grants actually issued for the irrigation of 1,303 acres.

**Staff.**—Owing to the recommendations of the Economy Committee one assistant engineer was retrenched towards the end of the year. The staff was practically at full strength throughout the year, with the exception of the Irrigation Engineer (Matabeleland), who was absent on long leave.

Acknowledgment is made of the loyal services rendered hy the whole staff of the division during the year.

# ANNUAL REPORT OF THE DIVISION OF FORESTRY

FOR THE YEAR 1931.

By E. J. Kelly Edwards, M.A., Dip.For.(Oxon.),
Senior Forest Officer.

## TWELFTH ANNUAL REPORT.

Despite adverse conditions, both financial and climatic, the Division of Forestry is able to report satisfactory progress for the year under review. Reduced funds and the need for economy in funds available have restricted operations, while the rainy season 1930-31, which started so well, failed abruptly early in the year and caused many losses to new plantings and sowings. It was therefore to be expected that in order to consolidate the ground previously gained the same expansion recorded for 1930 could not be achieved.

More extensive economies which are foreshadowed for the coming year will still further restrict our activities, but

rather than despair we prefer to regard these setbacks as purely temporary, and with the philosophy of the forester who knows that in spite of all the ills that trees are heir to, they will go on growing.

A sign of the times was the necessity for the establishment in September of a new European unemployment relief camp. With the figures of European labourers at Mtao swelling to 150, and comprising all types of unemployed and unemployables, it was found advisable to start a new camp at Stapleford, where higher rates of wage are obtainable, to relieve the congestion and to act as a promotion camp from Mtao. The Stapleford camp has a fixed capacity of forty men of the type genuinely seeking employment, and which can be recommended as outside employment becomes available. As men leave the camp the fixed number is kept up to strength by drafts from the Mtao camp.

At the end of the year there were 23 men at Stapleford, as accommodation for full capacity had not yet been completed. At Mtao 117 men were employed on the 1st January, 197 men were admitted during the year and 207 left; 107 men were employed at the end of the year. The behaviour of the men at both stations has been satisfactory.

As a result of the recommendations of an Economy Committee afforestation operations are to be considerably reduced during 1932. For the meantime no further plantings are to be undertaken on the Fairfield and Eastfield Patrols at Mtao, which are run by native labour. The necessary maintenance work will, however, be carried out. Operations at Stapleford will continue on a reduced scale.

Valuation surveys and inspections of forest areas on behalf of the Native and Lands Departments have served to confirm previous reports on the rapid forest destruction which is proceeding in certain parts of the Colony. In the Kalahari Sand Areas alone fire losses are truly appalling, and many "teak" forests are rapidly deteriorating to useless scrub. Destruction by natives through the non-regulation of cutting and deliberate firing is also in evidence to such an extent that in places there is already a timber shortage.

It is regretted that it has not yet been possible to institute fire protection in the Ngamo Forest Reserve in the

Wankie district. This reserve, 291,000 acres in extent, lies within an open shooting area where the destruction of game is encouraged to prevent the spread of tsetse fly. Unfortunately valuable Kalahari Sand forest is sharing the fate of the game, and the Forest Service remains powerless to intervene on behalf of the forest where hunters of all types are allowed free access. To attempt fire protection where trespass is untrammelled would be sheer waste of public money.

It is pleasing to record that, although over large areas of the Colony destruction of game is being ruthlessly carried out in connection with tsetse fly operations, in others sanctuary is being given to game in additional game reserves. It is probable that the Kalahari Sand forests owe their survival to the presence at one time of immense herds of game. Observations show that fire destruction on the grand scale is of comparatively recent occurrence, and dates possibly from the advent of the European and the rise in the native population from the end of the last century. The motives underlying game preservation are many, but it may be of interest to repeat the remarks of the Chairman at a general meeting of the Society for the Preservation of the Fauna of the Empire to the effect that "the survival of animal types might have greater value for our descendants than it had for us. We did not know why particular animals existed, but people in the future might be able to find significance in individual types, and it might make all the difference to them that particular types were preserved alive."

I desire to record with pleasure the efficient and loyal service during a trying year of all members of the Forest Service.

1. **State Forests.**—During the year approximately 96,500 acres of unreserved forest were added to the Victoria Falls Game Reserve. Farms Balcarres and Petty's, in extent 31,152 acres, in the Wankie Game Reserve, reverted to Government by exchange and are now included in the Reserve. An area in the Wankie district surrounding and including the Kazuma Pan and 48,745 acres in extent was proclaimed a game reserve. The Forest Nursery, Salisbury, was accurately surveyed and found to be 112.48 acres in extent.

The north-western and southern boundaries of the Gwaa Forest Reserve were demarcated.

At the end of the year the areas of State forests ir which operations were being carried out by the Forest Servic were as follows:—

| *Description.* | Area on 1st January. Acres. | Additions or Excisions during Year. Acres. | Total Are at 31st De( Acres. |
|---|---|---|---|
| (a) Reserved forests ... | 666,404 | + 12 | 666,41( |
| (b) Unreserved forests | 192,000 | − 96,500 | 95,50( |
| (c) National Parks and Game Reserves ... | 3,521,520 | + 176,397 | 3,697,91' |
| Totals ... ... | *4,379,924* | *+ 79,909* | *4,459,83* |

The boundary between the Stapleford Forest Reserve anc farm Charity 9,240 yards in length and 1,460 yards of th( boundary between farm Walmer and the Reserve were fence( in conjunction with the owners.

2. **General Maintenance.**—New compartments were surveyed and marked on the ground on the Mtao Forest Reserve. The stock maps of this Reserve have now been brought up tc date. The continuation of the contour survey of the Stapleford Forest Reserve was considerably impeded by shortage of staff.

Annual plans of operations prepared for all stations were adhered to as far as practicable. On account of bad planting weather and the fact that expenditure is to be considerably decreased the programme of planting and preparation of soil at Mtao was greatly altered.

A strip survey of indigenous tree veld at Mtao revealed an average volume of 232 cubic feet per acre for trees six inches and over d.b.h. Seventy-three per cent. by volume was represented by *Brachystegia randii* and *Berlinea globiflora*.

Sample plot measurements of eucalypts were continued at this station.

A preliminary valuation of the commercial timbers in the Gwaai Forest Reserve was completed. Valuation surveys were also made of 135 square miles of Crown land forest adjacent to the Reserve on behalf of the Lands Department,

and of 500 square miles of Kalahari Sand forest in the Bubi district on behalf of the Native Department.

3. **Protection.**—Regular patrols were carried out on the Stapleford, Mtao and Gwaai Forest Reserves, the Fuller-Kesi unreserved area and in the Wankie and Victoria Falls Game Reserves. During the year thirteen convictions were obtained for forest offences.

The usual but more intensive fire protection operations were carried out on the Stapleford and Mtao Forest Reserves. With the much reduced funds available for protection in the Kalahari Sand forests an attempt was made to protect the same areas as hitherto. Unfortunately intense early fires entered the Gwaai Forest Reserve before the external fire lines had been completed.

The fire protection on the reserves where plantings are in progress was extremely satisfactory. No fires occurred except at Mtao over half an acre of two-year-old *Eucalyptus crebra*, which was slightly damaged.

In the Kalahari Sand areas dry weather conditions resulted in the fire hazard being felt as early as May. Grass growth was unusually rank and fire fighting was attended with great risk.

On account of the absence of staff on seconded duty the amount of damage from fire has not yet been assessed, but provisional figures indicate that in the Masue Section 5 per cent., in the Fuller-Kesi Section 2 per cent. and in the Gwaai Forest Reserve 26 per cent. of the protected area were traversed by fire. This represents 19.3 per cent. of the total of 663 square miles protected.

Experience of fire protection in the Kalahari Sands indicates that rigid and prolonged intensive protection of wide areas is difficult and costly to achieve. Time may yet show that it is not even desirable. Methods of passing light fires through the forest at the right time of the year and of burning poor forest to safeguard groups of better quality are being evolved. If forest can be carried through the sapling and pole stages free from fire damage the main difficulty will be solved. Occasional subsequent fires may do little or no harm, provided they are not too frequent.

A system of classifying fires by the amount of damage done to the several component parts of a forest is being adopted. By this means a truer assessment of losses will be obtained and the technique of fire protection will be considerably improved. Whatever the system of protection adopted in this Colony, the key to success is adequate European supervision.

The damage from field rats at Stapleford was considerably greater than in previous years. *Cupressus lusitanica* was particularly favoured for attack, and pines were not left untouched. To cope with the evil heavy weeding has been undertaken. Experiments carried out with a rat virus have given negative results, but further trial is needed.

No frost damage was reported during the year.

The effects of drought during and after the rainy season were again evident throughout the Colony, particularly in young plantations. It is the incidence rather than the amount of rainfall which is of such vital importance to the establishment of plantations. Long periods of hot sunny weather following otherwise adequate precipitation were the cause of many setbacks during the past planting season.

4. **Silviculture.**—(a) *Natural Reproduction.*—The oft-recorded reproductive capacity of indigenous trees from stool and seed is again mentioned, and opportunity is taken to pay tribute to nature for her success against the persistent destructive efforts of frost, fire and man. Nevertheless, the combined efforts of 1,100,000 inhabitants aided by frost and fire are causing serious depletion of forest resources in certain areas, and the time has already arrived for more attention to be paid to the conservation of our forests generally.

Very heavy germination of seed was noted under nine-year-old eucalypts at Mtao. The seedlings, however, died off from exposure. No steps were taken to foster them, as regeneration was not sought.

(b) *Artificial Reproduction.*—Further evidence of the good results obtained from introducing mycorhiza to new pine soils was obtained. At Macheke, an area typical of the plateau sand veld, several rows of *Pinus insignis* in an unthrifty plantation were treated with inoculated soil. The treated plants, now two years old, have assumed the

characteristic healthy colour of the species and average two feet in height. The untreated plants continue in their stunted state. Blankings from an inoculated nursery are making good growth. It is worthy of note that at Mtao untreated pines after five years of meagre growth are now growing apace.

The afforestation operations carried out during the year were as follows:—

| Station. | Total Area Afforested 31.12.30. Acres. | Area Afforested 1931. Acres. | Total Area Afforested 31.12.31. Acres. |
|---|---|---|---|
| Forest Nursery, Salisbury ... ... | 36.50 | — | 36.50 |
| Mtao Forest Reserve | 1,448.87 | 205.00 | 1,653.87 |
| Stapleford Forest Reserve ... ... ... | 1,820.16 | 682.32 | 2,502.48 |
| Totals ... ... | 3,305.53 | 887.32 | 4,192.85 |

The areas for 1930 at Mtao and Stapleford have been reduced by survey adjustments and failures in certain *in situ* sown areas.

Heavy blankings were necessary at Stapleford and Mtao on account of drought, unfavourable planting weather, the failure of sown areas and damage by rodents. Weeding costs at Stapleford were considerably in excess of previous years, partly on account of the nature of the localities treated and partly to check rat infestations.

(c) *Interplanting of Indigenous Forests with Exotics.*—During the period 1924-26 extensive interplanting operations were carried out at Mtao with the objects of introducing a cheap method of afforestation by avoiding heavy stumping and clearing costs, and augmenting the yield of timber. The indigenous forest consisted of *Brachystegia randii* (msasa) and *Berlinea globiflora* (mnondo) tree-veld, with such associates as *Parinarium mobola* (muhatja), *Burkea africana* (mukarati), *Pterocarpus angolensis* (bloodwood), *Monotes glaber* (muwara), *Faurea saligna* (musasati), *Terminalia sericea* (mukonono), etc.

Strips three feet wide and six feet to twelve feet apart were hoed in the natural forest after a minimum amount of

clearing had been carried out. Thereafter 92 acres were interplanted with conifers and 140 acres with eucalypts.

For some years the results obtained were discouraging. Growth was extremely slow, due possibly to some toxic action of the msasa or to excessive root competition. Except in isolated cases under and near muhatja the growth of interplanted trees compared very unfavourably with that of the same species planted in completely cleared areas. In 1930 it was noted that better growth was being achieved, and in 1931 many of the interplanted species were definitely in the ascendant. Of particular interest is the fact that conifers such as *Callitris calcarata*, *C. glauca*, *Pinus insignis* and *P. pinaster* are now making rapid growth.

Although interplantings have been discontinued since 1926, on account of the slow initial growth, the experience gained indicates the possibility of augmenting poorly stocked hardwood forests with suitable softwoods and also with fast growing exotic hardwoods.

(d) *Nurseries and Sales of Seeds and Transplants.*—The abrupt failure of the rains in the middle of February caused a considerable decline in the revenue of the Salisbury Forest Nursery. There were 910 visitors to this nursery during the year. New nurseries were established at Stapleford and at the European relief camp, Mtao. For the ensuing year all plants for the Mtao Forest Reserve will be raised by the European labourers. During the year 5,188,500 transplants and seedlings were raised at all nurseries and 2,419,550 distributed, sold and planted.

(e) *Trial of New Species.*—The arboreta on all forest reserves were extended, particularly at Stapleford and in the Kalahari Sand areas.

Experimental plantings of the tung oil tree (*Aleurites fordii*) carried out by farmers in many parts of the Colony are showing promise. In Salisbury an individual tree flowered and fruited at four years of age. Another tree of the same age was severely scorched by a grass fire, but recovered completely during the present rainy season.

5. **Exploitation.**—Departmental exploitation was confined to utilising small quantities of indigenous timber and poles from plantations for local needs on the reserves for buildings and furniture, bridges and fencing.

Messrs. Rhodesian Native Timber Concessions and Zambesi Sawmills, Limited, continued exploitation of forests in the Kalahari Sand areas under concessions from the Department of Lands, to whom royalty is paid. The chief timbers exploited are "Rhodesian teak" (*Baikiæa plurijuga*), umtjibi (*Copaifera coleosperma*), bloodwood (*Pterocarpus angolensis*) and mugongo (*Ricinodendron rautanenii*).

In the Lomagundi district *Khaya nyasica*, so-called "Banket mahogany," is being exploited in a small way for furniture, panelling, etc.

6. **Roads, Communications and Buildings.**—At Stapleford 1,200 yards of branch road from the main reserve road were made to the new European labour camp. 8,760 yards of bridle paths were constructed.

At the European relief camp a two-roomed hut with lean-to kitchen for the Forester and a mess hall for the men were built with wattle and daub. Twenty rooms in blocks of four, a kitchen and store, all of tarred kimberley brick, were constructed for the European labourers.

On the Mtao Forest Reserve one and a half miles of new road were completed, and the fire telephone system extended along this road. New buildings comprised a hut at Fairfield and six huts at the new European labour nnrsery.

All reserve roads and buildings were kept in repair.

7. **Live Stock.**—The live stock on hand at the end of the year for all stations totalled 182 oxen, 18 mules, 7 horses and 19 donkeys.

8. **Revenue.**—The revenue (unaudited) for the year, including free issues and excluding timber royalties paid to the Department of Lands, was £1,763 7s. 6d., compared with £2,322 0s. 10d. for the previous year.

9. **Expenditure.**—Expenditure (unaudited) for the year, apart from salaries, allowances, travelling and transport of permanent staff, was:—

| | 1931. | | | 1930. | | |
|---|---|---|---|---|---|---|
| Afforestation and protection | £6,325 | 9 | 7 | £8,564 | 5 | 9 |
| European relief employment | 12,522 | 12 | 6 | 8,455 | 0 | 10 |
| Total ... ... ... ... ... | £18,848 | 2 | 1 | £17,019 | 6 | 7 |

In April a method of assessing the value of afforestation operations by European relief labour on a native labour basis was instituted in order to give a truer indication of the cost of forestry to the State.

10. **Administration.**—The staff of the Forest Service, exclusive of temporary labour, at the end of the year, consisted of 1 Senior Forest Officer, 4 District Forest Officers, 1 manager (Forest Nursery), 6 foresters, 1 game warden, 2 foremen, 4 apprentices and 1 clerk.

11. **Private Forests.**—During the year only twenty-one private properties were visited officially by officers of this Division. The growing responsibilities on the reserves, the shortage of staff at head office and the need to exercise economy in travelling expenses resulted in much less itinerant advisory duties than in previous years. While existing economic conditions prevail this cannot be remedied. It is nevertheless regretted that so much advice has to be given through the medium of correspondence, which must often be in general terms instead of the definite observations which would result from a field inspection.

The *areas under private plantations* have shown a remarkable increase in recent years. Available statistics give the following acreages: 1927-28, 8,605 acres; 1928-29, 13,791 acres; and 1929-30, 17,858 acres.

12. **National Parks and Game Reserves.**—No steps were taken to patrol or otherwise supervise the Matopo National Park on account of the lack of funds. The area of the Victoria Falls Game Reserve was considerably extended by the addition in October of 96,500 acres of Kalahari Sand forest. It is hoped that by strict protection game will soon return to this area, whence they have been driven by timber exploitation during the past few years.

The Kazuma Pan Game Reserve was proclaimed in October to deter excessive poaching along the Bechuanaland border. This area will be patrolled by the Victoria Falls game warden.

*Wankie Game Reserve: Patrols.*—During the year all boundaries of the Reserve were regularly patrolled by native rangers, except, on account of lack of water, the southern

portion of the western and the western portion of the southern boundaries. All water supplies were visited regularly. The game warden accomplished 800 miles of ordinary patrol and 1,500 miles of special patrol.

*Elephant Control.*—The existence of an open shooting area along the major portion of the eastern boundary necessitated the restriction of the movements of elephant into the danger zone. Many small herds were successfully prevented from leaving the reserve, but in July, when water became scarce, it became both impossible and dangerous to check the animals.

*Water Supplies.*—A water supply near Nyamandhlovu Pan was opened up by digging in May. On account of the fine sand and the frequent visits of game, it was necessary to re-open the supply weekly. On Balcarres an artificial pan was created and water led in a 100-yard concrete furrow from a windmill. The pan was lined with clay and was sufficiently water-tight to be kept full, although over 1,000 gallons were taken weekly by game.

During the major portion of the year the water supply was approximately half that of a normal year. Pans began to dry as early as May, and by November, when rains fell, all but eight had failed.

*Salt Licks.*—Almost every species of game visits the various salt licks at one time or another, and these salt deposits appear to have a direct bearing on the movement of game and concentration in various parts of the reserve. All licks are frequented during the winter and the hot weather preceding the first rains. During the spring the licks are not visited, and only to a small extent during the rains.

*Game.*—During the rains elephant frequent the sinanga country (*Acacia giraffæ* and *Acacia* spp.); thereafter their movements are regulated by availability of water. In spring msasa and mfuti forest is preferred for the new foliage, and again in winter when the seed pods are ripening. Many animals left the reserve for water after July and suffered heavy losses from trap-guns and hunters in the open shooting area. Calves are mostly born in August. Some very fine tuskers were seen in the north of the reserve in July. Rogues

caused much trouble in that locality, and one made a very determined attack on the game warden.

The number of giraffe found in the teak forests increases from March to July. From then onwards they gradually move into the sinanga, where they remain until the end of the rains. The young are born in the winter months, though it is not uncommon to find young animals six months old in June.

The majority of eland calves are born in June and July, at which time the herds are very scattered and seldom contain more than 20. From August to October the herds begin to bunch, so that numbers of 500 in a herd are not uncommon. By the middle of November the calves begin to form small herds and, accompanied by a few old cows, separate from the main herd. From February to October the bulls run alone and usually frequent the sinanga. The large herds break up about January, each herd being accompanied by a bull.

Oryx are seen frequently at all times of the year and mostly in Kalahari Sand forest. Before the advent of the rains the herds appear to bunch and frequently change locality in search of grazing rather than water, for they can apparently dispense with water for months at a stretch.

Wildebeeste, sable and roan are much affected by drought, as they are grazers rather than browsers. Several sable were found dead in October from poverty.

Vermin shot during the year comprised 12 lions, 6 leopards, 29 hyæna and 3 wild dogs. Lions and leopards are not particularly troublesome, but hyænas and wild dogs caused much damage.

*Game Catching.*—During the year a young giraffe was captured and presented to the Pretoria Zoo. The game warden accompanied the animal by train and spent some days at the zoo in studying the management and care of animals in captivity.

13. **General.**—*Trout Acclimatisation.*—The trout at Stapleford continue to thrive, and during the year a fine specimen measuring 14 inches and weighing 1½ lbs. was caught and presented to the museum in Salisbury. In

August a further supply of 7,500 ova was obtained from the Umtali branch of the Angling Society and hatched in two hatching boxes. The fry were then liberated in the Odzani River.

*Publications.*—The publications during the year, excluding an article in the press, were:—

(1) "The Camelthorn (*Acacia giraffæ*, Burch)," by J. S. Henkel, F.R.S.(S.Af.); (2) "Establishing Pines—Preliminary Observations on the Effects of Soil Inoculation," issued by the Division of Forestry; (3) "The Raising of Forest Seedlings and Transplants on the Farm," by E. J. Kelly Edwards, M.A., Dip.For.(Oxon.); (4) "The Woodland Types of Southern Rhodesia," in two parts, by J. S. Henkel, F.R.S.(S.Af.)—the foregoing appeared in the *Rhodesia Agricultural Journal;* (5) "Provisional Map of the Types of Vegetation in Southern Rhodesia" (coloured, scales 16 miles to an inch and 32 miles to an inch), by J. S. Henkel, Surveyor General's Office, Salisbury; (6) "Types of Vegetation in Southern Rhodesia," by J. S. Henkel, Dip.For., F.R.S.(S.Af.)—Proceedings of the Rhodesia Scientific Association, Vol. XXX., 1931.

# THE EIGHTH ANNUAL MAIZE GRADING AND EXPORT CONFERENCE.

The eighth Maize Grading and Export Conference was held this year on the 19th April in the offices of the Department of Agriculture, and was attended by the following: Messrs. Jacklin (Chairman, Maize Control Board), Garmany (Maize Control Board), J. Buckmaster (Farmers' Co-operative Society and Maize Control Board), Worthington-Reid (Gwelo Maize Pool), McLeod (Fort Victoria Farmers' Co-operative Society), Parker (Maize Association), W. Rogers (Dreyfus and Co.), G. L. Robertson (District Superintendent of Transportation, Rhodesia Railways), together with

the Chief, Division of Plant Industry, the Assistant Agriculturist and the Senior Grain Inspector.

The chair was taken by the Chief, Division of Plant Industry, who, after welcoming the delegates, summarised the results of the enquiries and investigations undertaken by the Department of Agriculture at the request of the previous Conference, and which had already been reported upon in full in the *Rhodesia Agricultural Journal* or in the local press.

Amongst other matters dealt with, the following of general interest to farmers may be recorded:—

1. **Matters arising out of Resolutions adopted at the last Conference.**—Mr. Buckmaster recorded appreciation on behalf of the members of the Farmers' Co-operative Society of the valuable advice in regard to harvesting methods which had been issued during the year by the Division of Plant Industry. The Hon. John Parker suggested that it would be advisable to republish past advice to refresh the memories of growers and to remind them of the many difficulties experienced in past seasons in presenting dry maize bagged in acceptable condition for export, particularly having in mind the late drying conditions of the present season. Mr. Worthington-Reid thought it was now largely a question of farm discipline; he considered that experienced growers could protect their own interests, but he appealed for further Departmental contact with growers in the Gwelo and Fort Victoria areas, which had not previous to last season participated in export overseas. He recommended a summary of past advice in draft under a covering letter for distribution to associations in those areas.

2. **Maize Grading Staff.**—This item, introduced by Mr. Jacklin, was discussed at considerable length and by all delegates. Mr. Jacklin stressed the desirability of economy in regard to the handling of maize, and the importance of loading direct into trucks wherever possible. He considered that at points where stacking space was limited, special consideration should be given to applications for farm grading, provided that consignments were reasonably large ones. He further emphasised the importance of the availability of graders as and when required, and was of the opinion that a reduction in the number of graders on last

year's strength would place his Board in difficulties this season in view of the larger export anticipated.

Mr. Buckmaster considered it impossible for the Board's checkers to receive, grade and load maize during the early part of the export season, but thought the privilege of grading their own maize might be applied in special cases or urgent demands and rushes. He recorded his appreciation of the grading duties as performed by the Government graders last season.

The desirability of employing permanent and experienced graders was vigorously voiced, and after much discussion the number of graders required for the coming export season was agreed upon in terms of the following resolution, which was passed unanimously:—

> "That in view of the large maize crop anticipated this season and the considerable export to be expected, this Conference considers it essential that a nucleus of at least four experienced graders should be maintained from the end of June onwards, assisted by such additional temporary graders as circumstances demand."

3. **Transport of Graders.**—The Conference again stressed the necessity of adequate motor transport for graders and their equipment, particularly in view of a further restricted train service on the branch lines.

4. **Quality of Maize.**—A further appeal was made by the Gwelo and Fort Victoria delegates, who urged the importance of tuition and advice being given in their areas, where export is still in its infancy. Last year's experience was cited of a depot which was literally nothing more than a "drying out" station instead of an export depot.

One delegate was of the opinion that native maize was improving in quality and that in certain areas European maize was deteriorating in quality. It was stated that a higher grade of maize was now required for conversion into meal than in the past, and that it was incumbent on growers to ensure that their maize was free of chaff, dirt, broken grain and diplodia infected grains. If attention was not paid to this, millers would buy the best native maize in preference to the inferior European grown article.

The smaller shelling outfits were criticised for the excess of chaff and undesirable grain contained in many samples, due to an insufficient "blast" and to improper screening; these, together with the shelling of maize in too damp a condition and the running of machines at incorrect speeds, were the primary causes of inferior quality in the bagged product. The undesirable presence of diplodia infected grain was attributed to carelessness on the part of the farmer in not eliminating diseased cobs at the time of threshing.

5. **Pigeon-hole Stacking.**—Mr. Buckmaster informed the Conference that this method of restacking wet maize in accordance with the recommendations of the Department of Agriculture had proved very satisfactory in all instances where it had been used last season, but the limited space at many sidings and stations rendered the adoption of the system impossible on any extensive scale. He considered it highly desirable that the practice should be encouraged on farms, and that farmers in fear of over-moist maize should stack their bags direct from the sheller. The following resolution was moved and carried:—

> "That the Department of Agriculture take immediate steps to call the attention of maize growers to the efficiency of pigeon-hole stacking and to the advantages of adopting this system on the farm immediately after shelling, with the object of ensuring an accelerated drying out of the maize during the interval between shelling and transportation to the railway."

Mr. Garmany emphasised the unnecessary risk and cost of insurance against fire when the bags are stacked on maize husks (envelopes), and recommended the more general use of "cobs," poles and second hand railway sleepers, since these caused little risk of fire and provided better protection against white ants and soil moisture.

# PIGEON-HOLE METHOD OF STACKING MAIZE.

(Bulletin No. 822, Revised.)

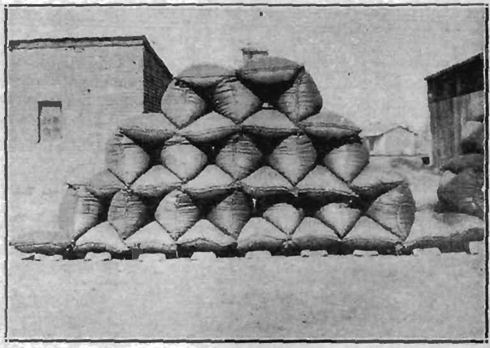
By the DIVISION OF PLANT INDUSTRY.

At the eighth Maize Grading and Export Conference recently held in Salisbury stress was laid by various delegates on the advantages of applying the pigeon-hole method of stacking to maize on the farm, direct from the sheller, as compared with the same method when employed at stations or sidings for maize temporarily rejected for export on account of excessive moisture. It was recommended that the Department of Agriculture republish at the earliest possible date the information contained in Bulletin No. 822 together with the illustration.

The original recommendations for restacking were made mainly in respect of maize delivered to stations and sidings and later found by the graders to be excessively wet. It is now found that at certain points on the railway line space is a limiting factor and that this method of restacking maize can only therefore be employed in certain circumstances, and even so at considerable inconvenience and expense to the farmer.

In order to keep down costs to a minimum and to ensure that maize is delivered in the driest possible condition for export, it is now recommended that wherever there is the least doubt as to the dryness of the maize the pigeon-hole method of stacking should be adopted on the farm, where space is of little consideration, where dunnage is plentiful and cheap and where the maize can be thus stacked direct from the sheller, so affording it the greatest possible opportunity to dry out during the interval between the shelling and transportation to rail head.

The farmer who has taken all the necessary precautions against wet maize when harvesting and who is satisfied that his grain does not contain more than 12.5 per cent. moisture, will naturally not need to adopt this system of stacking. On the other hand rather than run the risk of having his maize rejected on the railway line and then being required to pigeon-hole stack, or wait at least three weeks before it is re-examined, he will be well advised to stack in this manner on the farm in the first instance.



The method of pigeon-hole stacking recommended.

The method of pigeon-hole stacking recommended is as follows:—

*Vide* illustration: The bottom layer of bags are laid on the dunnage on their broader sides, and the next tier is placed with their narrower sides resting in the depressions which occur where the bags in the lower layer meet each other. The third tier is arranged similarly to the first, and so on until the stack is five or seven tiers—no more—in height.

Bagged maize stacked during the dry winter months under the above system dries out more rapidly than under any other system so far devised. An instance of this may

be quoted. Last season a certain consignment stacked in the usual manner—i.e., block stacked—was rejected on account of excessive moisture. It was left for two months, and even at the end of that time still contained 12.9 per cent. of moisture. It was then restacked on the pigeon-hole system and in seven days had dried out sufficiently to pass the test.

Should any portion of the crop already delivered to the railway line be found to be excessively moist, growers are advised to discontinue riding to the railway until they have submitted a representative sample of the remainder of the grain for moisture test, and have, if necessary, pigeon-hole stacked the undelivered balance of the crop on the farm.

Restacking either on the farm or on the railway cannot but entail considerable added expense, and the remedy for the need of such measures lies in the grower ensuring that the wettest of his grain is dried out to within at the utmost .2 per cent. of the maximum permitted for export before he commences delivery to the railway line.

Much, if not all, of the difficulty experienced in regard to over-moist maize can be overcome by the grower exercising greater supervision when harvesting, and by learning to judge the moisture content more accurately. This last can be achieved by submitting samples to the Department of Agriculture for test and by retaining on the farm in a similar air-tight receptacle a part of the sample for comparison when the result of the test is communicated.

# AGRICULTURAL EXPERIMENT STATION, SALISBURY.

## ANNUAL REPORT OF EXPERIMENTS, 1930-31.

PART I.

By H. C. ARNOLD, Station Manager.

*Published with the authority of the Chief, Division of Plant Industry.*

During the season under review the total rainfall at this station was 31.47 inches, which almost equals the mean annual precipitation, but of this total 26.21 inches fell between the 1st December and the 8th February, after which date only one shower exceeding half an inch was recorded. The intervals between the other showers were so prolonged as to render them almost valueless. It will be realised, therefore, that while the rainfall exceeded requirements during the early part of the season, the lack of rain during the critical grain development period may be assumed to have reduced the yields considerably. The rainfall for the period 9th February to the 31st March was the lowest recorded for several years.

*Analysis of Rainfall, Season* 1930-31.

| Month. | No. of rain days. | Total for month. | No. of rains over ¼ inch. | Total to end of month. | Periods exceeding 1 week without rain. |
|---|---|---|---|---|---|
| October .. .. ... | — | Nil. | — | Nil. | — |
| November ... | 6 | 2.63 | 3 | 2.63 | Nil. |
| December ... | 23 | 11.09 | 10 | 13.72 | Nil. |
| January ... ... | 18 | 10.14 | 8 | 23.86 | Nil. |
| February ... ... | 11 | 6.02 | 9 | 29.88 | Feb. 22-Mar. 2. |
| March .. ... | 6 | 1.11 | 2 | 30.99 | Mar. 3 to 8. |
| April ... ... ... | 3 | 0.48 | 1 | 31.47 | Mar. 18 to 30. |
| | 67 | 31.47 | 33 | — | 3 periods of 7 days or over. |

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is framed on similar lines to previous ones.

Having served their purpose, the following experiments have been discontinued:—

1. Maize planted on the previous season's tobacco ridges without ploughing the land.

2. Maize following green manures ploughed under early *versus* ploughed under late.

3. Maize distance-planting trials for grain.

4. Canna distance-planting trials.

5. Canna *versus* sweet potato trials.

New investigations commenced include:—

1. Maize in widely spaced rows with and without a leguminous crop between the rows *versus* the usual planting of 36 ins. x 18 ins.

2. Comparison on the yield of maize of lime *versus* raw rock phosphate of equal cash value, when applied in addition to a basal dressing of superphosphate and potash.

3. Comparison of the effects of burning a crop of sunn hemp on the land, with that of an application of a like amount of the same ash burnt elsewhere, compared with the ploughing under of the entire crop as a green manure.

## CROP ROTATION EXPERIMENTS.

### First Series, 1913-31.

*Maize Yields in Bags per Acre.*

| System of cropping. | 1930-31: Rainfall, 31.47 inches. | 1929-30: Rainfall, 23.46 inches. | 1928-29: Rainfall, 31.62 inches. | 1927-28: Rainfall, 26.63 inches. | 1926-27: Rainfall, 22.39 inches. | Average yields. |
|---|---|---|---|---|---|---|
| *A1. Maize continuous green manured, plus 250 lbs. per acre bone meal and 19 per cent supers in 1928-29 (17th year) ... ... ... | 12.60 | 15.88 | Green manure ploughed under. | 1.90 | 5.25 | ... |
| *A2. Maize continuous, 250 lbs. per acre bone and supers to the maize in 1928-29 (17th year) ... ... ... | 2.99 | 11.44 | 6.20 | ... | ... | ... |
| †B. Alternate maize and bare summer fallow; no manure or fertiliser | 1.95 | 6.43 | 5.65 | 8.15 | 10.20 | 10.05 |
| C. Three-course rotation: maize, velvet beans (reaped), oats: no manure or fertiliser ... | 11.70 | 11.36 | 12.00 | 12.15 | 16.90 | 14.78 |
| D. Four-course rotation: maize (plus 6 tons dung per acre), oats, velvet beans (reaped), maize; average of 2 maize plots ... .. ... | 14.93 | 15.79 | 19.00 | 17.45 | 23.45 | ... |
| Maize (no manure direct) ... .. ... ... ... | 14.95 | 13.25 | 21.35 | 14.10 | 24.80 | 18.31 (15 years) |
| Maize (dunged plots) ... | 14.90 | 18.33 | 16.65 | 20.80 | 22.05 | 19.56 |

* Note.—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate, at the rate of 250 lbs. per acre, at the beginning of the 1928-29 season. One half of the plot was then planted to maize, while the other half was sown to a mixture of Sunn hemp and velvet beans, which were subsequently ploughed in.

† In 1929-30 this system was amended from "Alternate maize and bare summer fallow" to "Alternate maize and dolichos beans for hay."

The beneficial effect of green manuring is once again clearly shown by the yields of the A plots. During the three seasons 1929-31 the A2 plot (which received fertiliser only) has yielded a total of 20.63 bags per acre, whereas in the same period on the A1 plots the *two* maize crops following the ploughing under of green manure have yielded 28.48 bags. The green manuring has therefore added nearly 8 bags of maize to the yield and a further slight economy has been effected by reason of there being only two heavy crops to handle instead of three light ones. No more important experimental result than this has been recorded in the history of Rhodesian experiment stations, and the conclusion arrived at is fortunately confirmed by the experience of a number of practical farmers. The renovation of worn-out land is usually a lengthy and expensive process, and the knowledge that a soil so exhausted by constant cropping as to be incapable of producing two bags of maize an acre, by one green manuring and the use of 200-300 lbs. of artificial fertilisers costing perhaps £1 per acre, can be restored to an economic state of fertility in one season is, as far as is known, almost without parallel elsewhere.

*System B.*—When comparing the tabulated yields for this rotation, it must be remembered that they are for a two-year period, whilst those for the A plots are annual yields. The former show that after cropping the land to maize with bare fallow in alternate seasons, over a period of 15 years, its crop-producing ability remained greater than that of the A plots before they received fertiliser treatment. The only advantage over continuous annual cropping has been that gained through the economy of handling heavier crops on a smaller area. This experiment has conclusively shown that the bare summer fallow is not an effective and economic factor in the management of arable land in Rhodesia.

Having demonstrated that bare fallowing is not beneficial, this experiment has served its purpose and last season it was decided to introduce dolichos beans for hay in place of the bare fallow. The soil, however, was so depleted in fertility that the growth of the dolichos beans that season was exceedingly poor and no benefit from the change can be indicated in this report.

*System C.*—In this case the land is cropped every year, and although it carries maize but once in each three-year period, the yields are so much higher than those in system B as to clearly show that maize may be produced more economically when grown in rotation with other crops than in alternation with fallow. Except for the ploughing under of the dry crop residues, no manure or fertiliser has been applied to this land at any time during the past 18 years.

*System D.*—Although the dressing of farmyard manure applied in this system is comparatively small, the yields are being well maintained. Not only are the maize crops heavier than in rotation C, but the oat and bean crops are also much more luxuriant.

A comparison of the original four methods of cropping adopted in these experiments very strikingly exemplifies the economy of soil fertility which is effected by a suitable rotation of crops, and the increased yields which follow when rotation is combined with the use of even small amounts of farm manure.

## Second Series of Crop Rotations.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series includes two plots, A and F, on which maize was grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of plot A continues as in the past, but on plot F, commencing last season, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quality and quantity as that accorded in rotational system H, but green manuring is entirely omitted.

### *Plot A, System E.*

Maize continuous without manure or fertiliser.

*Seasons and Yields of Maize in Bags per Acre.*

| 1930-31. | 1929-30. | 1928-29. | 1927-28. | 1926-27. | 1925-26. | Average over 12 years. |
|---|---|---|---|---|---|---|
| 2.33 | 7.85 | 7.65 | 6.5 | 10.6 | 12.0 | 11.39 |

### *Plots B to E, System F.*

Three quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receiving 200 lbs. per acre of superphosphate (19 per cent. $P_2O_5$).

*Maize Yields in Bags per Acre.*

| | 1930-31. | 1929-30. | 1928-29. | 1927-28. | 1926-27. | 1919-20. | Average, 1920-31. |
|---|---|---|---|---|---|---|---|
| Plot B ... ... | 9.10† | Sudan g. | 14.55 | 17.00* | 18.15 | 26.0 | 18.21 |
| Plot C ... ... | Sudan g. | 13.33 | 10.15* | 8.50 | Sudan g. | 23.0 | 15.40 |
| Plot D ... ... | 9.10 | 15.78* | 9.55 | Sudan g. | 16.25 | Sudan g. | 17.02 |
| Plot E ... ... | 13.42* | 13.90† | Sudan g. | 11.60 | 20.30* | 24.6 | 16.36 |
| Average ... ... | 10.54 | 14.34 | 11.42 | 12.36 | 18.27 | 24.7 | 16.75 |

* Indicates the application of farmyard manure.
† Indicates the application of 200 lbs. per acre superphosphate.

The beneficial effect of an application of farmyard manure is very clearly shown by this experiment, but the reason for the comparatively low yield of 9.10 bags per acre following a dressing of 200 lbs. per acre superphosphate is not yet apparent. The lack of humus in the soil, combined with an unfavourable season, may probably be the chief causes. The average yield of the plots during 1930-31, it will be noted, is nearly four bags per acre less than that for the previous year.

### *Plot F, System G.*

Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

*Seasons and Yields of Maize in Bags per Acre.*

| 1930-31. | 1929-30. | 1928-29. | 1927-28. | 1920-21. | 1919-20. | Average over 12 years. |
|---|---|---|---|---|---|---|
| 7.03 | 6.38* | 6.1 | 4.8 | 24.2 | 23.3 | 11.37 |

* Indicates the application of 200 lbs. per acre superphosphate.

Fertiliser of the same kind and in the same quantities is applied to this plot as in System H below, but in this case no-humus, either in the form of farmyard or green manure, is given. In this way information regarding the practicability or otherwise of profitable maize production on soil lacking humus though amply supplied with phosphates should be provided.

In spite of the unfavourable weather conditions, a somewhat heavier yield of maize was reaped on this plot during the season under review than in the previous season when a direct application of fertiliser was made. This corroborates the results obtained on System A in the first series of rotation trials. It has already been noted that unfavourable weather conditions appear to have reduced the yield in System F this season, by approximately four bags per acre; if this amount is added to the seven actually reaped in System G, the results are strikingly similar to those obtained in System A, viz., six bags in the season of application and eleven bags in the following season. It appears probable that when the fertility of the land has become much reduced by repeated cropping to maize, the humus and nitrogen content of the soil is so depleted as to prevent immediate use being made of the phosphate. But the increased root development of the fertilised crop adds some humus, and probably increases the population of nitrifying bacteria, so that in the second year, the humus and nitrogen having to some extent increased, larger use can be made of the phosphate residue in the soil.

*Plots G to K, System H.*

Three-quarters of the land under maize, one quarter under velvet beans, which are ploughed under for green manure. From the commencement of the experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop—that immediately in front of the green crop—receives 200 lbs. per acre of a mixture of bone meal and superphosphate. Under the revised system it is anticipated that heavier green manure crops will be available for ploughing under, and this combined with the additional application of artificials should result in a satisfactory maintenance of soil fertility.

Plate No. 1.

First Series of Rotations, Plot A and B, 1931.—In background on right: Plot A—maize after fertiliser plus green manuring. In foreground: Plot A—maize after fertiliser without green manuring. Left background: System B—maize following dolichos beans reaped for hay.

Plate No. 2.

First Series of Rotations.—Maize in System C sown 29th November, 1930. Photo taken 31st January, 1931. Compare with maize in foreground and on left of Plate No 1. The beneficial effect of crop rotation is very evident.

Method of Cultivation Trials.—Foreground: Maize on weedy, uncultivated land. Note the unhealthy light yellow colour of the plants compared with that of the maize in the background, which has received the same treatment except that it has been properly cultivated to kill the weeds.

Method of Application of Fertiliser Trials.—Left foreground: Fertiliser broadcasted and harrowed in a few days before planting seed. Right foreground: Fertiliser applied in the seed holes. Background: Fertiliser applied in the drills at planting time. The forcing effect of the two last methods of application is well demonstrated.

*Yields of Maize in Bags per Acre.*

| | 1930-31. | 1929-30. | 1928-29. | 1927-28. | 1926-27. | 1919-20. | Average, 1920-31. |
|---|---|---|---|---|---|---|---|
| Plot G ... ... | 16.80* | Beans | 8.75 | 14.50* | 17.90 | 23.10* | 15.99 |
| Plot H ... ... | Beans. | 10.70* | 9.00 | 14.40 | Beans. | 23.00 | 15.56 |
| Plot J ... ... | 6.10* | 7.57 | 17.50 | Beans. | 14.20 | Beans. | 15.07 |
| Plot K ... ... | 7.53 | 16.00* | Beans. | 7.80 | 14.70* | 19.20 | 14.51 |
| Average ... ... | 10.14 | 11.42 | 11.75 | 12.23 | 15.60 | 21.70 | 15.28 |

* Indicates application of fertiliser.

Previous seasons' results are again corroborated in this rotation, and further support is given to the conclusions drawn from Systems F and A in showing that disappointing results follow the application of phosphatic fertiliser to land poor in humus. The tabulation shows that Plot J yielded 17.5 bags per acre in 1928-29, after being green manured in the previous season, but in spite of the application of 200 lbs. of bone and super this season only 6.1 bags per acre were obtained, as compared with 16.80 bags per acre from Plot G, which benefited by both green manure and fertiliser.

These rotation experiments all support each other in showing that results following applications of phosphates to soils lacking in humus are almost invariably disappointing. The failure of the crop to respond to fertiliser is more marked in seasons when climatic conditions are unfavourable, but apart from the fact that it is impossible to foretell whether a season will be favourable or otherwise, the maintenance of an adequate supply of humus in the land should be regarded as a matter of first importance.

*Fertiliser and Green Manure Trials.*—This experiment was commenced in 1928-29 to determine whether it is more profitable to apply fertiliser to a green manure crop which is to be followed by maize, or to apply the fertiliser direct to the maize crop after ploughing under an unfertilised green manure crop.

The plots on which these experiments are carried out had previously been used for fertiliser trials with maize. Some were of average fertility after having received moderate dressings of fertiliser, but the productive capacity of others had been much reduced by constant cropping without the addition of manure of any kind. Thus the two methods of applying fertiliser are being tried out on land of moderate

fertility as well as on land of low fertility. On half of the plots raw phosphate rock is used, and on the other half a mixture of one-third bone meal and two-thirds superphosphate; in each case the fertiliser is applied at the rate of ·200 lbs. per acre.

In the tabulation below, the four plots which gave the lowest yields during the season preceding the commencement of these trials are grouped separately from the remaining four higher yielding plots in each class, in order that comparison of the effects of treatment may be facilitated.

*Yields of Maize in Bags per Acre.*

| | Fertiliser applied to green manure crop. | | | Fertiliser applied direct to maize (after green manure). | | |
|---|---|---|---|---|---|---|
| | Season 1927-28 (before trials began). | Season 1929-30. | Season 1930-31. | Season 1927-28 (before trials began). | Season 1929-30. | Season 1930-31. |
| *All plots of* low fertility. | 0.52 | 13.44 | 8.72 | 1.04 | 14.00 | 10.28 |
| | 2.08 | 18.40 | 12.64 | 4.08 | 15.60 | 8.04 |
| | 4.20 | 18.96 | 10.80 | 4.16 | 17.32 | 15.60 |
| | 4.32 | 17.60 | 8.40 | 5.32 | 16.72 | 12.88 |
| Totals ... | 11.12 | 68.40 | 40.56 | 14.60 | 63.64 | 46.80 |
| Averages | 2.78 | 17.10 | 10.14 | 3.65 | 15.91 | 11.70 |
| Differences | — | 14.32 | 7.36 | — | 12.26 | 8.05 |
| All plots of *moderate* fertility. | 4.72 | 17.40 | 8.64 | 5.84 | 16.72 | 13.84 |
| | 7.32 | 17.92 | 11.48 | 6.60 | 18.12 | 10.72 |
| | 7.64 | 17.00 | 12.84 | 6.72 | 18.52 | 10.44 |
| | 8.28 | 20.72 | 14.32 | 9.36 | 18.16 | 12.88 |
| Totals ... | 27.96 | 73.04 | 47.28 | 28.52 | 71.52 | 47.88 |
| Averages | 6.99 | 18.26 | 11.82 | 7.13 | 17.88 | 11.97 |
| Differences | — | 11.27 | 4.83 | — | 10.75 | 4.84 |

The returns for the first maize crop following the green manure and fertiliser treatment indicated that only when the fertility of the land had been reduced to a very low level was the practice of fertilising the green manure crop likely to prove economical. The average of two seasons' results still support this conclusion, although on the low fertility plots the yield this season was somewhat heavier from the plots on which the fertiliser was applied direct to the maize, due apparently to the larger amount of residual fertiliser which was available for this season's crop. No evidence in favour of fertilising the green manure crop on moderately fertile land is yet furnished by these results.

*The Relative Effect of Raw Phosphate Rock and Bone and Superphosphate.*—In the season 1928-29 when the fertiliser was applied to the green manure crop, four plots were dressed with raw rock phosphate and another four with a mixture of one-third bone meal and two-thirds superphosphate, while a further eight plots were reserved for similar treatment the following season. In view of the different treatments given in previous years and the resulting performances of these plots, however, it was found impossible to divide them equally between the two kinds of fertiliser without giving a bias in favour of one or the other, and it was decided to apply each kind of fertiliser on separate halves of all the plots. In this way each of the fertilisers was applied direct to the maize on eight one-sixteenth-acre plots instead of to four one-eighth-acre plots, as was the case when the fertiliser was applied to the green manure crop in the previous season. The returns from the two fertilisers are tabulated below. To facilitate comparison of their relative effect, the plot yields for the season preceding the commencement of these trials are included.

*Yields of Maize in Bags per Acre.*

FERTILISERS APPLIED TO GREEN MANURE CROP.

| | Yield before trials began, 1927-28. | Raw phos. rock, 1929-30. | Raw phos. rock, 1930-31. | Yield before trials began, 1927-28. | Bone and supers., 1929-30. | Bone and supers., 1930-31. |
|---|---|---|---|---|---|---|
| | 0.52 | 13.44 | 8.72 | 4.72 | 17.40 | 8.64 |
| | 2.08 | 18.40 | 12.64 | 4.32 | 17.60 | 8.40 |
| | 4.20 | 18.96 | 10.80 | 7.32 | 17.92 | 11.48 |
| | 8.28 | 20.72 | 14.32 | 7.64 | 17.00 | 12.84 |
| Totals ... | 15.08 | 71.52 | 46.48 | 24.00 | 69.92 | 41.36 |
| Averages | 3.77 | 17.88 | 11.62 | 6.00 | 17.48 | 10.34 |

FERTILISER APPLIED TO MAIZE.

| | Yield before trials began, 1927-28. | Raw phos. rock, 1929-30. | Raw phos. rock, 1930-31. | Bone and supers., 1929-30. | Bone and supers., 1930-31. |
|---|---|---|---|---|---|
| | 4.08 | 17.20 | 8.56 | 14.00 | 7.52 |
| | 4.16 | 17.84 | 9.44 | 16.80 | 12.00 |
| | 5.04 | 13.44 | 10.08 | 14.56 | 10.48 |
| | 5.32 | 16.88 | 10.48 | 16.56 | 10.40 |
| | 5.84 | 16.64 | 14.08 | 16.80 | 13.60 |
| | 6.60 | 16.88 | 15.28 | 19.36 | 15.92 |
| | 6.72 | 19.04 | 12.96 | 18.00 | 12.80 |
| | 9.36 | 18.08 | 11.92 | 18.24 | 13.84 |
| Totals ... | 47.12 | 136.00 | 92.80 | 134.32 | 96.56 |
| Averages | 5.89 | 17.00 | 11.60 | 16.79 | 12.07 |

Where the fertiliser was applied to the green manure crops, the returns slightly favour the raw rock phosphate, but those for the plots on which the fertiliser was applied direct to the maize indicate equally beneficial effects from both kinds of fertiliser in both the first and second seasons.

In laboratory tests and under certain soil conditions, the phosphorus in raw rock phosphate has been proved to be less readily available for the use of plants than that contained in superphosphate, and this has been reflected in lower yields during the first season after application. In the present experiment, however, the raw rock phosphate has proved as efficacious as the bone and superphosphate in the first season. The results indicate that in this Colony on soils which are acid in nature and well supplied with vegetable matter, dressings of raw rock phosphate may normally be expected to increase the maize yield during the first season just as greatly as similar dressings of bone and superphosphate, and further, that owing to its lower cost the rock phosphate may well prove the more economical fertiliser.

*Method of Application of Fertiliser Trials.*—These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which fertiliser is applied to the land is likely to affect the yield of the maize crop. Fertilisers were applied in four different ways, namely:—

1. Broadcast during winter and ploughed in.
2. Broadcast shortly before planting time and harrowed in.
3. In drills at the time of sowing the seed.
4. In holes by hand with the seed at the time of planting in check rows.

Fertiliser was applied at the rate of 200 lbs. per acre. In the season 1928-29 a mixture composed of one-third bone and two-thirds superphosphate was used, but in 1929-30 and during the season under review Rodia Double Complete Fertiliser was given instead. A new site was also chosen for these experiments and the plots were arranged in the form of two Latin squares. Each method of applying the fertiliser was replicated eight times.

The following table records the yields of maize in lbs. per one-twentieth acre plot:—

*Method of Applying Fertiliser.*

Lbs. per plot of one-twenty-fourth acre.

| | Ploughed in. | Harrowed in. | Drills. | Holes. | |
|---|---|---|---|---|---|
| Experiment No. 1— | 37 | 56 | 64 | 60 | |
| | 48 | 41 | 47 | 73 | |
| | 75 | 47 | 62 | 84 | |
| | 97 | 52 | 88 | 66 | |
| Totals of 4 plots | 239 | 196 | 261 | 283 | S.E. = 9.0 |
| Bags per acre ... | 7.17 | 5.88 | 7.83 | 8.49 | S.E. = 0.27 |
| Experiment No. 2— | 74 | 40 | 64 | 63 | |
| | 67 | 67 | 73 | 65 | |
| | 68 | 67 | 65 | 69 | |
| | 63 | 43 | 75 | 79 | |
| Totals of 4 plots | 272 | 217 | 277 | 276 | S.E. = 14.2 |
| Bags per acre ... | 8.16 | 6.61 | 8.31 | 8.28 | S.E. = 0.426 |

S.E. = Standard error.

In the first experiment, owing apparently to localised soil infertility, one plot on which the fertiliser was ploughed under gave a very low yield, and, owing to this, the yield from the plots fertilised in that manner that year appear lower than they otherwise would. That this result should be taken with reserve is shown by the second experiment, in which three out of the four methods of applying the fertiliser have proved equally efficacious. But where the fertiliser was broadcasted on the surface and harrowed in, the response to the treatment was definitely less in both experiments. This season's results therefore corroborate those previously reported.

On the plots on which the fertiliser was concentrated near the maize plants, the acceleration of the vegetative growth during the first two months was very marked. There are differences of opinion as to whether forcing the growth in this way is advantageous or otherwise. Some favour it, because the plants are assisted in their competition against weeds and earlier use of inter-row cultivators is made possible. Other farmers, who use drag harrows for the preliminary weedings, prefer the comparatively wiry early growth which results when the fertiliser is broadcasted, because it permits the harrows to be used two or three times before the plants become too large to be further cultivated by such means. It may be observed also

that large plants which are deep green in colour are more attractive to stalk-borer moths than less luxuriant plants.

That the harrowing-in of fertiliser should prove less effective than the other methods is unfortunate, because under general conditions this is the least expensive and most convenient method of application. The question arises as to whether the proportion of the fertiliser constituents not used by the crop the first year may not be utilised in the following year, in which case, when regular application of fertiliser is practised, the temporary loss of a small proportion may not prove serious.

To investigate this aspect of the problem, it is proposed to re-arrange the plan and in future to practise each method of applying fertiliser on its own particular group of plots over a period of years, when, if after the first year or two the yields of the "harrowed-in" plots equal those of the other methods, that method of applying the fertiliser will have been shown to be the most economical, in spite of the temporary loss of a bag or two of maize the first season.

*Cultivation Trials.*—The *raison d'etre* for these investigations was the announcement by certain investigators that the maintenance of a soil mulch as a result of cultivation had no beneficial influence on crop yields, apart from that conferred by the destruction of weeds. The experiments were laid down in 1928-29 to investigate the truth of this theory under local conditions, and the methods of treatment were as follows:—

(a) Weeds allowed to grow unchecked.

(b) Weeds removed without disturbing the surface of the soil.

(c) Weeds destroyed and soil mulch formed by the usual methods of machine and hand cultivation.

In the first season weed infestation was light, the rainfall was ample and evenly distributed and there was little difference in the yield of the plots under the different treatments. In the following season the land was considerably more weedy and the weeds were allowed to seed, with the result that in 1930-31 there was a heavy infestation of weeds over all the plots.

During the seasons 1929-30 and 1930-31 the rainfall was less than normal towards the end of the season and the presence of weeds had a decidedly harmful effect. In the table given below the mean yield of each series of replicated plots is expressed as a percentage of the mean of all the plots in the series.

| Season. | Rainfall during the month of March. | Weeds unchecked. | Weeds removed. | Usual cultivation. |
|---|---|---|---|---|
| 1928-29 ... ... ... ... | 6.30 ins. | 97.1% | 102.5% | 101.4% |
| 1929-30 ... ... ... ... | 3.75 ins. | 85.7% | 101.5% | 112.9% |
| 1930-31 ... ... ... ... | 1.11 ins. | ... | ... | ... |
| Series No. 1 ... | ... | 48.7% | 99.7% | 151.3% |
| Series No. 2 ... | ... | 63.7% | 110.8% | 122.2% |

*Yields of Maize in Bags per Acre.*

| Season. | Rainfall during the month of March. | Weeds unchecked. Per cent. | Weeds removed. Per cent. | Usual cultivation. Per cent. |
|---|---|---|---|---|
| 1928-29 ... ... ... ... | 6.30 ins. | 24.64 | 26.03 | 25.85 |
| 1929-30 ... ... ... ... | 3.75 ins. | 14.59 | 17.27 | 19.21 |
| 1930-31 ... ... ... ... | 1.11 ins. | ... | ... | ... |
| Series No. 1 ... | .. | 4.56 | 9.33 | 14.16 |
| Series No. 2 ... | .. | 12.71 | 22.79 | 24.41 |

It is considered that these returns conclusively indicate that in Southern Rhodesia at least, weed suppression is not the only factor responsible for the beneficial results which follow thorough cultivation, but that the maintenance of a loose surface mulch is also materially helpful, either because it checks evaporation or because it facilitates the penetration of rains into the soil, or by a combination of both these effects.

*One Ploughing* versus *Two Ploughings for Maize Production.*—In some countries it is the usual practice to cross-plough land before seeding, in addition to the preliminary autumn or winter ploughing, and the object of this experiment was to investigate the question of whether the yield of maize would be increased by ploughing the land a second time in addition to the usual winter ploughing.

With these plots all the land was ploughed, rolled and harrowed during the winter months. After soaking rains had fallen the area was divided into four blocks, each of which was sub-divided into two, one of each pair being further dug

over by hand, while on the other this process was omitted. The second working being by hand, the work was probably performed a good deal more thoroughly than it would have been by the plough and better results might therefore be expected.

In order that the influence of the differences in inherent fertility of the plots might be overcome as far as is possible, the plots which were once ploughed last season were twice ploughed this season and *vice versa.*

The following table shows the yields over two seasons:—

*Yields of Maize in Bags per Acre.*

| Season. | Block 1. Ploughed: once. | Block 1. Ploughed: twice. | Block 2. Ploughed: once. | Block 2. Ploughed: twice. | Block 3. Ploughed: once. | Block 3. Ploughed: twice. | Block 4. Ploughed: once. | Block 4. Ploughed: twice. | Mean yields of 4 blocks. Ploughed: once. | Mean yields of 4 blocks. Ploughed: twice. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1929-30 ... | 21.48 | 22.24 | 20.76 | 22.52 | 21.72 | 20.84 | 19.76 | 22.36 | 20.93 | 21.99 |
| 1930-31 ... | 13.20 | 13.68 | 16.70 | 15.50 | 13.68 | 12.80 | 13.44 | 15.12 | 14.26 | 14.28 |
| Average for 2 seasons | 17.34 | 17.96 | 18.73 | 19.01 | 17.70 | 16.82 | 16.60 | 18.74 | 17.60 | 18.13 |

These returns show an average annual increase of half a bag per acre in favour of the plots which were twice ploughed, but it is doubtful whether this was due as much to the second ploughing as to the higher natural fertility of the plots which were twice ploughed in the first season. It will be noticed that the second season's yields favour twice ploughing by only .02 bag per acre, and it is thought therefore that the indicated increase of one bag per acre in the first season may have been largely due to other circumstances than the additional "ploughing."

These trials seem to confirm the general opinion that one thorough ploughing followed by adequate surface working is sufficient, and that a second ploughing is not likely to prove economical unless it is done for specific reasons, such, for example, as to destroy weeds, or turn in fertiliser or manure.

*The Effect of Cultivating Young Maize with Spike-toothed Harrows.*—There exists considerable diversity of opinion amongst farmers as to whether the cross-harrowing of young maize crops is advisable or otherwise. These experiments were devised for the purpose of obtaining information

which would be helpful to farmers in deciding whether harrowing may safely be practised, or whether it is more expedient to employ less drastic means of ridding the land of weeds.

The trials were conducted over a period of two seasons. The maize was sown in rows 40 inches apart and the plants were spaced at four different distances in the rows, namely, 8 inches, 12 inches, 15 inches and 15 inches with two grains per hill, to allow of subsequent thinning to one plant per hill. Each season the seed hed has been well prepared and a set of harrows of medium weight, drawn by six oxen, have been used. The absence of trash and clods probably made conditions somewhat more favourable than would pertain on the average farm. Each season the crop has been twice harrowed transversely to the direction of the rows, the first harrowing being given about fifteen days after sowing the seed, and the second ten days later. The plots were replicated five times in 1929-30 and six times during the season under review.

The following table indicates the percentage of plants which were destroyed by the harrows, and the yields, the figures given being the means of the replicated plots.

*Yields of Maize in Bags per Acre.*

| Distance between plants in row ... ... | 8 ins. | | | 12 ins. | | | 15 ins. | | | 15 ins. (Two grains sown per hill.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of plants per acre ... | 19,602 | | | 13,068 | | | 10,454 | | | 10,454 | | |
| Season. | Per cent. destroyed: 1st | 2nd | Yield, bags p.a. | Per cent. destroyed: 1st | 2nd | Yield, bags p.a. | Per cent. destroyed: 1st | 2nd | Yield, bags p.a. | Per cent. destroyed: 1st | 2nd | Yield, bags p.a. |
| 1929-30 ... ... | 1.7 | 7.4 | 13.93 | 3.3 | 18.0 | 14.96 | 4.2 | 19.0 | 14.63 | 2.2 | 11.2 | 13.44 |
| 1930-31 ... ... | 0.6 | 3.5 | 12.29 | 0.9 | 4.4 | 13.86 | 1.5 | 6.8 | 11.93 | 1.2 | 2.9 | 10.98 |
| Totals ... ... | 2.3 | 10.9 | 26.22 | 4.2 | 22.4 | 28.82 | 5.7 | 25.8 | 26.56 | 3.4 | 14.1 | 24.42 |
| Averages ... | 1.2 | 5.5 | 13.11 | 2.1 | 11.2 | 14.41 | 2.9 | 12.9 | 13.28 | 1.7 | 7.1 | 12.21 |
| Ratio of destruction of 1st harrowing to 2nd harrowing ... | 1:4.6 | | | 1:5.3 | | | 1:4.4 | | | 1:4.2 | | |

These returns indicate that the number of plants destroyed by the second harrowing was more than four times as great as those destroyed by the first harrowing, which caused an average loss of only 2 per cent. Of the 44 plots in these experiments, only one sustained a loss as high as 6 per cent. as a result of the first harrowing. It will be seen therefore that usually this means of cultivation may be safely employed when the maize plants are between one and two weeks old, if precautions are taken to prevent the harrows from becoming clogged with maize and weed trash, clods, etc. After the plants have reached the height of one foot there is more risk of destroying them, and during the early hours of the day and on dull days, at which times the stems are turgid, harrowing should not be practised.

In both seasons heavier yields were obtained where the plants were spaced at 12 inches apart in the rows. It is thought that this was largely due to chance, but it may be noted that in 1929-30, when the stand was reduced by 21.3 per cent., nearly 3,000 plants per acre were destroyed, making the average distance between the remaining plants 15.2 inches, and for the same reason where the plants were first spaced at 15 inches apart, the average distance between plants in the final stand was increased to 19.5 inches. It was observable that at the second harrowing a much larger proportion of the plants was destroyed where the soil was very loose and friable, due apparently to the deeper penetration of the spikes causing the framework of the implement to flatten the plants so much that a number were broken off and others were covered with soil. This suggests that harrows with long spikes may be found preferable for use on open and sandy soils. The returns further indicate that where the plants were more widely spaced in the rows, a larger proportion were destroyed by the harrows. This is contrary to expectation and no explanation for it can be given.

Owing to the limited area available for these trials, and the necessity for the replication and randomisation of experiment plots, it was not possible to include areas on which harrowing was not practised.

Although somewhat incomplete, these trials have served a useful purpose in demonstrating that when this method of cultivation is employed, the stand will not be seriously reduced if reasonable precautions are taken. They also indicate that on weed infested land where the harrows may need to be used two or three times, it may be advisable to allow for a 15 to 25 per cent. reduction of the stand by sowing the maize somewhat closer in the rows.

# THE CONTROL OF WITCH WEED

## BY TRAP-CROPPING WITH SUDAN GRASS.

By the DIVISION OF PLANT INDUSTRY.

The following interesting report has been forwarded to the Chief, Division of Plant Industry, by Mr. George Gray, of Brawlands Farm, Glendale, and should be read carefully by all maize growers who are so unfortunate as to have lands infected with witch weed:—

"In 1929-30 I had 30 acres of exceptionally good soil, which, however, was very badly infested with witch weed; so much so, indeed, that I only reaped just under two bags per acre.

"For the following year your Assistant Agriculturist, Mr. Timson, advised me to try Sudan grass as a trap crop, and this I did, using 25 lbs. of seed to the acre, broadcasted and harrowed in. The seed was sown on the 20th December 1930, the land having been first ploughed. Eight weeks later I reaped a very fine crop of Sudan grass hay, which, in my opinion, is a very valuable cattle food.

"I then ploughed in 15 acres of the stubble without seeing any sign of witch weed. During the ploughing process Mr. Timson visited the farm and we both searched very

carefully, but could not find one single witch weed plant on this land. Mr. Timson, however, was of the opinion that the parasite had germinated, and this year's crop of maize certainly goes to prove that he was correct.

"On the other 15 acres I intended to keep the second growth for seed, but I happened to visit this part of the farm about ten days later and found that witch weed was in flower all over this area. I therefore decided to plough under at once the Sudan grass stubble and the witch weed showing amongst it. This season I planted maize on the whole of this 30 acres and expect to reap at least 14 bags to the acre, in spite of the fact that the ground was not fertilised. Witch weed has been present amongst the maize, but in such small quantities as to be easily controlled. It has been most prevalent on the 15 acres where the Sudan grass was allowed to make a certain amount of second growth, and where the witch weed was thus given an opportunity to flower and apparently to seed.

"Sudan grass as a green manure crop, in my opinion, is of even more value than Sunn hemp, since it has the advantage of being a host for witch weed. On the land which I had under Sunn hemp last season, I certainly have a really good crop of maize this year, but I have also easily ten times more witch weed."

In connection with the final observation in Mr. Gray's report, it appears usual for the infestation of witch weed (if it occurs in a field) to show an increase following a green manuring. The reasons probably are (1) that little or no seed of the parasite germinated under the Sunn hemp crop and there was thus all the more lying dormant in the land to germinate the following season, (2) the increased root development of the maize due to the increased fertility of the soil brought the roots into contact with and germinated a larger number of witch weed seeds than would the smaller root system of a less vigorous maize crop.

# TOMATO GROWING AT CERES, SHAMVA.

*[The following notes on tomato growing have been supplied by Mr. A. R. Morkel, of Ceres, Shamva. This farm is probably well known to many of our readers; it is situated a few miles south of Shamva at an altitude of approximately 3,600 feet. The soil is a deep rich loam, varying from red to chocolate in colour to almost black. It is fortunate in the possession of an irrigation system with sufficient water to irrigate 800 acres of land. The orchards, wheat lands and vegetable gardens are all under the irrigation furrow.*

*The climate is almost tropical, and the farm is sufficiently sheltered to be protected from frosts.*

*As might be expected, tropical fruits do well, but all attempts to grow deciduous fruit trees have been a failure.*—Ed.]

**Soil Preparation.**—Tomatoes are grown on the best available patches of soil. Black and red soils are both good, but there should be plenty of humus. Green crops—Sunn hemp preferably, but velvet beans and cow peas are both useful—are the rule when there is no kraal manure. The latter at the rate of ten to fifteen tons per acre is the best provision of humus. A liberal supply of phosphates is given to the tomato crop in addition to the kraal manure, dressings being from three hundred to four hundred lbs. per acre. The ploughing under of a thick Sunn hemp crop (sowings being thirty to forty lbs. Sunn hemp seed to the acre) is one of the best means of getting humus and obtaining a good friable soil such as the tomato loves. A top dressing of sulphate of ammonia given to the transplants after they are set out for a week or two gives them a very noticeable push, which helps the plants to go ahead without any setbacks.

**Seeding.**—*The seed-beds are established in a nice, warm* corner close to irrigation and well away from low-lying wet lands. Enough seed is sown every Monday from the end of January until the beginning of August to enable ten boys to be busy once a week transplanting when the plants are two to four inches high. Liberal dressings of kraal manure (in this case sheep manure), phosphates and sulphate of ammonia are given to the seed-beds. This gives vigorous transplants—a necessity if a good crop is required.

**Transplanting.**—Care in the usual way must be exercised in digging up the young plants. The transplants should be removed gently, disturbing the soil surrounding the roots as little as possible. The plantlets are placed in boxes covered with a sack and taken to the field, where the land has already been prepared in the following manner. It is first ploughed, harrowed and then ploughed and harrowed again until in good tilth and there are no clods visible. Between the first ploughing and harrowing and the last one the kraal manure is scattered. The second ploughing buries this properly. When the soil is in a satisfactory condition, boys make furrows four feet apart and about twenty to thirty yards long. Too long a furrow causes erosion at the upper ends, and a furrow at a grade which causes the water to dam up is not good for tomatoes. Into these furrows water is now led until they are thoroughly damp. The phosphates are then evenly distributed and the trench filled ready for planting. The plants are set out from three to four feet—preferably four feet—apart in the rows. Immediately after irrigating the soil is hoed up around the plants, thus making practically a new channel for the water to flow down. This will in the end bring the rows of tomatoes in the middle of the hoed-up row. This is done to prevent the soil being washed away from the roots of the plants and to obviate all caking and hardening of the soil near the roots.

The success of tomato-growing is dependent on proper treatment of the soil, due regard to weather conditions, patient, frequent and careful cultivation, spraying with the necessary fungicides, careful picking and packing, and perhaps above all—orderly marketing.

**Staking, etc.**—When the plants are from a foot to eighteen inches high they are pruned. Pruning consists of pinching off all stems but two—or at the most three—for a distance of at least six inches from the ground. It will be noticed that immediately after the pruning the growth improves remarkably. The pruning finished, each four plants are tied to stakes, and these stakes in turn are tied together. When a crop is growing well it may also be necessary to tie the branches to the stakes as the plant reaches a higher level.

**Varieties.**—"Perfection" has been grown for many years on this farm. It grows well, keeps well, packs well and sells well. "Ponderosa" is a new variety here, but it promises to do extremely well. If the fruit is as good as it is claimed to be, then this variety will give great satisfaction. There are already clusters of fruit and abundance of clusters. The growth of the plants has been more vigorous than any other varieties grown here hitherto. "Sunrise": This is a variety of a pleasing colour and beautiful shape, and promises to be a good second to "Ponderosa" in its attractiveness, and like the latter it is later than "Perfection" and can therefore be marketed at a time when winter-grown tomatoes should be in good demand.

**Diseases and Pests.**—The only diseases that have been a source of trouble are mosaic and wilt. Care is taken to pull up and immediately destroy all plants in which the mosaic makes its appearance. Sometimes about five per cent. of the plants are affected by mosaic, but generally it is much less.

Wilt is something I have still to study. Very little information is as yet available with regard to the cause of wilt. It has been noticed here that this disease attacks old and young plants, vigorous plants just commencing to fruit and old plants that have been bearing for a couple of months all at the same time. It has also been remarked that a few crops well away from the main crop do not become affected. It is hoped that an experiment this year with a plot under irrigation, but at least half a mile away from the land under the main crop, will give results by which we will know if it is the proximity to the main crop which causes the younger plants to become infected with wilt. Perhaps after having

grown tomatoes in a frostless region throughout the winter it is too much to expect them to grow during the summer and rainy season as well.

I make my own Bordeaux mixture, using 6 lbs. copper sulphate and 4 lbs. quick lime to 50 gallons of water. The copper sulphate I buy from the Postal Department at 4d. per lb. The mixture requires careful straining through a fine mesh before use to get rid of the small particles of lime which are liable to choke the spray. A spray of tobacco juice is also beneficial to get rid of beetles that destroy the flowers occasionally. This latter pest is, however, not serious.

Several piccanins have to watch that birds do not eat the fruit, and in spite of this labour quite an appreciable amount of fruit is thus destroyed. All marked and damaged fruit is picked every day and given to the pigs, which thrive on it.

In sorting, a large number of over-ripe fruit always comes to the grading table, and this also is sent to the pigs.

**Packing.**—This is done for most dealers in boxes containing from twenty to twenty-three lbs. nett weight of tomatoes. Banana leaves are placed at the bottom and top and between the two layers of fruit. It is advisable to pack the fruit fairly tightly without squeezing it. All fruit of one size is packed in each box, but not all of one degree of ripeness. This is done to allow the buyer a percentage of his purchase to ripen gradually, so that he has no waste on his hands through over-ripe fruit. I have known tomatoes from this farm, well packed, to be in a good state of preservation for eating nearly a month after they were picked.

**Selling.**—It is of great help to have an attractive label, so that it may be known as a well-packed fruit. Fruit of any kind, if it does not look tasty, will not sell well. Tomatoes from Ceres have a good name from Beira to Bulawayo, and even up to Northern Rhodesia.

**Yields.**—No very accurate records have been kept of yields hitherto. Tomatoes have been sold as follows from the acreages mentioned, but in addition a large quantity of each year's yields was given to the labourers and to the pigs, such fruit being over-ripe for selling purposes.

| Year. | Acres. | Tomatoes sold. | Yield per acre. |
|---|---|---|---|
| 1928 ... ... ... ... | 4 | 48,000 lbs. | 12,000 lbs. |
| 1929 ... ... ... ... | 4½ | 54,000 lbs. | 12,000 lbs. |
| 1930 ... ... ... ... | 8 | 126,020 lbs. | 15,765 lbs. |
| 1931 ... ... ... ... | 15 | 207,360 lbs. | 13,824 lbs. |

These figures are only approximate, but can be accepted as a guide to enable one to estimate what yields are to be expected from well-managed fields of tomatoes.

The crop is an expensive one to grow and the nett profit is not all that it might be, but there are few crops that are more interesting.

# GWEBI PRODUCE PRICES.

| | |
|---|---|
| Hull-less oats ... ... ... ... ... ... ... | 40/- per bag of 150 lbs. |
| Large Black sunflower seed ... | 14/- per bag of 100 lbs. |
| Dolichos beans ... ... ... ... ... ... | 35/- per bag of 200 lbs. |
| Linseed ... ... ... ... ... ... ... ... ... | 60/- per bag of 200 lbs. |
| Linseed (quantities under 100 lbs.) ... ... ... ... ... ... ... ... | 4½d. per lb. |
| Sweet potato tubers (Calabash Leaf) ... ... ... ... ... ... ... ... | 6/- per bag of 150 lbs. |
| Napier fodder roots ... ... ... ... ... | 6/- per bag of 40 lbs. |
| Sweet potato cuttings (Calabash Leaf) ... ... ... ... ... ... ... ... | 6/- per bag of 40 lbs. |
| Edible canna corms ... ... ... ... ... | 10/- per bag of 150 lbs. |
| Pumpkin seed ... ... ... ... ... ... ... | 1/1 per lb. |

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

# A LIST OF PLANT DISEASES OCCURRING IN SOUTHERN RHODESIA.

SUPPLEMENT 2.

**(June, 1931, to May, 1932.)**

Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

This second supplement to the original list published in 1930 consists of newly recorded diseases for the year June, 1931, to May, 1932, and also includes several fungi collected prior to 1926 by Mr. F. Eyles and not included in his preliminary list (*Bull.* 602, *Dept. of Agric.*, Salisbury, 1926). The latter are indicated by the symbol (*F.E.*).

I am indebted to the Director and staff of the Imperial Mycological Institute and to Miss E. M. Wakefield for a number of determinations.

ALOE (*A. greatheadii* Schoenl.).
Rust. *Uromyces aloes* (Cke.) P. Magn.

ARAUCARIA (*A. braziliana* A. Rich.).
Die-back. *Botryodiplodia theobromæ* Pat.

ASTER (*Aster* sp.).
Leaf Blotch. *Alternaria* sp.

BAMBOO (*Bambusa* sp.).
Foot Rot. *Helminthosporium* near *sativum* Pammel, King and Bakke.

BARBERTON DAISY (*Gerbera jamesonii* Hook.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).

BARLEY (*Hordeum* spp.).
Foot Rot. *Fusarium* sp.

BAUHINIA (*Bauhinia macrantha* Oliv.).
Leaf Blotch *Cercospora ? latimaculans* Wakef.

BEANS.

BROAD BEAN (*Vicia faba* Linn.).
Mosaic. Virus.

SOYA BEAN (*Glycine soja* Sieb. & Zucc.).
Leaf Spot *Bacterium glycineum* Coerper.
Mosaic. Virus.

SWORD BEAN (*Canavalia ensiformis* DC.).
Leaf Blotch *Alternaria brassicæ* (Berk.) Sacc. var *phaseoli* Brun. affin.

*Berlinia globiflora* Hutch. & Burtt Davy.
Mildew *Erysiphe* sp.

BLACK JACK (*Bidens pilosa* Linn.).
Smut *Entyloma bidentis* P. Henn.

*Brachystegia randii* Bak. f.
Anthracnose *Colletotrichum lindemuthianum* (Sacc. & Magn.) Br. & Cav. affin.

CARNATION (*Dianthus caryophyllus* Linn.).
Leaf and Stem Spot. *Phyllosticta dianthi* West.

CHRYSANTHEMUM (*Chrysanthemum* spp.).
Rust. *Puccinia chrysanthemi* Roze.

CITRUS.

LEMON.
Storage Rot *Penicillium italicum* Wehm.

COFFEE (*Coffea arabica* Linn.).
Brown Blight *Glomerella cingulata* (Stonem.) S. & v.S.
(=*Colletotrichum coffeanum* Noack.)

COLEUS (*Coleus* sp.).
Foot Rot *Pythium debaryanum* Hesse.

COTTON (*Gossypium* spp.).
Leaf Spot *Mycosphærella gossypina* (Cke.) Atk.
Seedling Blight *Rhizopus stolonifer* Ehrenb.
Sooty Mould *Fumago vagans* Pers.

COTYLEDON (*Cotyledon* sp.).
Purple Rot *Phytophthora parasitica* Dast. emend. Ashby and *Rhizoctonia* sp.

COWPEA (*Vigna catjang* Wolfs.).
Anthracnose *Colletotrichum lindemuthianum* (Sacc. & Magn.) Br. & Cav.

DAHLIA (*Dahlia* spp.).
Tuber Rot *Cephalothecium roseum* Ferraris.

DELPHINIUM (*Delphinium* sp.).
Foot Rot *Pythium debaryanum* Hesse.

*Desmodium leiocarpum* G. Don.
Leaf Spot *Colletotrichum* (*atramentarium* group).

*Dolichos lupiniflorus* N. E. Br.
Mildew *Erysiphe polygoni* DC.
Rust *Æcidium* sp. (*Uromyces appendiculatus* affin.)

*Doryalis* sp.
Leaf Spot *Coryneum doryalidis* van der Byl (*F.E.*)

EGG PLANT (*Solanum melongena* Linn. var. *esculentum* Nees.).
Mildew *Oidium* sp. (in glasshouse).
Rust *Æcidium habuguense* P. Henn.

EUCALYPTUS (*Eucalyptus rostrata* Schlecht.).
Root Rot *Fusarium* sp.

*Euphorbia prostrata* Ait.
Rust *Uromyces proëminens* (DC.) Lév.

GRAM (*Dolichos biflorus* Linn.).
Leaf Spot *Cercospora canescens* Ell. & Mart. affin.
Mildew *Oidium* sp. (? *Erysiphe polygoni* DC.).

GRAPE VINE (*Vitis vinifera* Linn.).
Shrivelled Fruit. Associated with *Aspergillus niger* v.Tieg.

GRASSES.

*Acroceras macrum* Stapf.
Leaf Spot *Phyllosticta* sp.

*Andropogon gayanus* Kunth.
Rust. *Puccinia versicolor* Diet. & Holw.

*Andropogon shirensis* Hochst.
Rust *Puccinia erythræænsis* Pazschke.

*Brachiaria brizantha* Stapf.
Leaf Spot *Phyllachora sanguinolenta* Theiss & Syd. var. *microspora* Doidge.

*Dicanthium papillosum* Stapf.
Smut *Ustilago ? dinteri* Syd.

*Digitaria setivalva* Stent.
Rust *Puccinia digitariæ* Pole Evans. affin.

*Hyparrhenia filipendula* Stapf.
Leaf Spot *Leptostroma* sp.

*Panicum maximum Jacq.*
Rust *Uromyces leptodermus* Syd.

*Pennisetum ciliaris* Link (= *P. cenchroides* Rich.).
Ear Mould *Cerebella cenchroidis* Subram. affin.

*Pogonarthria squarrosa* Pilg.
Rust *Puccinia* (? sp. nov.).

*Rhynchelytrum roseum* Stapf. (= *Tricholæna rosea* Nees.).
Leaf Spot *Phyllachora tricholænæ* P. Henn.

*Sorghum sudanense* Stapf.
Downy Mildew *Sclerospora graminicola* Schroet.

*Themeda triandra* Forsk.
Ear Mould *Cerebella andropogonis* Ces. affin.

*Urochloa pullulans* var. *mosambicensis* Stapf.
Ear Mould *Cerebella panici* Tracey & Earle affin.
Rust *Uromyces leptodermus* Syd.

GUAR (*Cyamopsis psoralioides* DC.).
Wilt *Fusarium* sp. near *vasinfectum* Atk.

HOLLYHOCK (*Althea rosæ* Cav.).
Foot Rot *Pythium* sp.
Leaf Spot *Ascochyta parasitica* Faut., associated with aphis.

HYDRANGEA (*Hydrangea* sp.).
Leaf Spot *Colletotrichum* sp.
Mildew *Oidium sp.*

KUDZU (*Pueraria thünbergiana* Benth.).
"Halo" Spot *Bacterium medicaginis* var. *phaseolicola* (Burk.) Link. & Hall. (= *B. puerariæ* Hedges).

LETTUCE (*Lactuca sativa* Linn.).
Damping-off *Pythium debaryanum* Hesse.
Leaf Spot *Septoria lactucæ* Pass.

*Leucas martinicensis* R. Br.
Rust *Puccinia leucadis* Syd.

MAIZE (*Zea mays* Linn.).
Seed Infection *Aspergillus niger* v.Tieg.

*Nicandra physaloides* Gærtn.
Leaf Spot *Alternaria* (*solani* group Mason.).
Mosaic. Virus.

OATS (*Avena sativa* Linn.).
Stem Rust *Puccinia graminis* Pers.

*Pedilanthus tithymaloides* Poit.
Mildew *Oidium* sp.

PETUNIA (*Petunia* spp.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).
Mosaic. Virus.

PHLOX (*Phlox drummondii* Hook.).
Leaf Spot *Septoria drummondii* Ell. & Ev.

POTATO (*Solanum tuberosum* Linn.).
Black Dot *Colletotrichum atramentarium* (Berk. & Br.) Taubh.
Common Scab *Actinomyces scabies* (Thaxt.) Güssow.
Mildew *Oidium* sp. (? *Erysiphe cicharacearum* DC.) (in glasshouse).
Wilt *Verticillium* (cf. *albo-atrum* Reinke & Berty) and *Fusarium culmorum* (W.G.Sm.) Sacc.

*Pterocarpus erinaceus* Poir.
Leaf Spot *Catacaumi pterocarpi* Doidge. (*F.E.*)

QUINCE (*Cydonia vulgaris* Pers.).
Leaf Spot *Fabræa maculata* (Lév.) Atk. (*F.E.*)

RHUBARB (*Rheum rhaponticum* Linn.).
Crown Rot *Phytophthora parasitica* Dast. var. *rhei* Godfr.

ROSE (*Rosa* sp.).
Leaf Spot *Glœosporium* sp.

SAFFLOWER (*Carthamus tinctorius* Linn.).
Leaf Spot *Alternaria* (*solani* group Mason.).

SESBANIA (*Sesbania* sp.).
Rust *Uromyces argyrolobii* Doidge.

STRAMONIUM (*Datura stramonium* Linn.).
Damping-off *Rhizoctonia solani* Kühn.
Seed Infection *Alternaria* (*tenuis* group Mason.).

SUDAN GRASS (*Sorghum sudanense* Stapf.), see Grasses.

SUNFLOWER (*Helianthus annuus* Linn.).
Dodder *Cuscuta arvensis* Beyr.
Neck-crack. ? Drought effect (cf. Chrysanthemum neck-crack).

SUNN HEMP (*Crotalaria juncea* Linn.).
Leaf Spot *Mycosphærella pinodes* Berk. & Blox.

SWEET POTATO (*Ipomœa batatas* Poir).
Ring Rot *Rhizopus stolonifer* Ehrenb.

SWEET SULTAN (*Centaurea moschata* Linn.).
Mildew *Oidium* sp. (? *Erysiphe cichoracearum* DC.).

TOBACCO (*Nicotiana tabacum* Linn.).
Leaf Curl. Virus.

TOMATO (*Solanum lycopersicum* Linn.).
Fruit Spot *Colletotrichum phomoides* (Sacc.) Chester.
Fruit Sunscald. Physiological.

VIOLET (*Viola odorata* Linn.).
Leaf Spot. *Alternaria violæ* (Gall.) Dors.

ZINNIA (*Zinnia* sp.).
Leaf Spot *Alternaria macrospora* Zimmerm. affin.

# FARMING CALENDAR.

## June.

### BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

### CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

### CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

### DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months

the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

## DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

## ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

## FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials,

shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

## VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

## FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

## GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

## POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

## STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold morn-

ings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

### TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

### VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evideuce now. Inoculation can be carried out now. Scab is a poverty winter disease.

### WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

## July.

### BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favonrable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

### CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

## CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

## DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

## DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

## ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects;

or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

## FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

## VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

## FORESTRY.

Care should be taken to protect all plantations from fire hy hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. *If labour is available, preparation of land for* planting to be taken in hand.

## GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

## POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended

that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

### STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

### VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

### WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

# SOUTHERN RHODESIA VETERINARY REPORT.

## March, 1932.

### AFRICAN COAST FEVER.

#### Melsetter District.

*Springvale.*—Most of the cattle on Springvale were slaughtered, and the remainder will be destroyed in April.

*Roede Farm.*—The disease was diagnosed on this farm; mortality, two. The appearance of coast fever on this farm

confirms the fact that the oxen which passed through en route to Melsetter from the infected farm Tilbury in May last year were infected at the time. The cattle on Orange Grove are also involved, as they dip with the Roede cattle on Orange Grove annexe.

*Melsetter Commonage.*—A case occurred on the commonage which is also due to infection from Tilbury oxen.

*Constantia and Clifton.*—Three cases occurred on these farms, and as the cattle dip with those on the farms Corner, Dunblane, Rocklands, Westfield and Jamieson, a considerable area and number of cattle are involved.

## FOOT AND MOUTH DISEASE.

### Gwelo Veterinary District.

Infection has spread to several more camps in the Central Estates, Chilimanzi district. The disease is clearing up in the Charter, Selukwe and Belingwe districts.

### Bulawayo Veterinary District.

*Belingwe District.*—The cattle at High Peak were inoculated. Infection was found to exist south of the inoculated area on Belingwe Reserve, and is being dealt with.

*Bubi District.*—The Battlefields Block and Ntabazinduna Reserve are now clean, and the Shangani Ranch is clearing up.

### Victoria Veterinary District.

No further outbreaks. The disease is clearing up in all areas, and the whole of the Chibi district is now clean.

### Salisbury Veterinary District.

The last infected centre, Chiweshe Reserve, has been declared clean.

## HORSE-SICKNESS.

Nineteen cases reported from the Bulawayo veterinary district and five from Gwelo.

## TRYPANOSOMIASIS.

Cases reported from two farms on the eastern border, Melsetter district, and on one farm in the Gatooma area.

## MYIASIS (SCREW WORM IN CATTLE).

This is very prevalent in some districts, and especially so in foot and mouth disease infected herds.

## BLUE TONGUE.

Heavy losses have been reported amongst sheep in the Melsetter district in spite of inoculation.

## SNOTZIEKTE.

Two cases reported on the Central Estates, Chilimanzi district.

## ANAPLASMOSIS AND PIROPLASMOSIS.

Both redwater and gall-sickness have been more in evidence this season, due to relaxation of dipping owing to the existence of foot and mouth disease and restricted movements.

## IMPORTATIONS.

From the Union of South Africa: Cows and calves, 4; bulls, 17; heifers, 25; horses, 8; sheep, 1,609; goats, 90; pigs, 57.

## EXPORTATIONS.

Nil.

## CORRECTION—FOOT AND MOUTH DISEASE.

In the report for December, 1931, it was stated that some infection still existed on Sections 1, 4, 6 and 9 of Liebig's. This was incorrect. There was no infection on Sections 1 and 6 of Liebig's, but on Sections 1 and 6 of the Cattle Inspector's area in the Tuli section of the Gwanda district.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

# SOUTHERN RHODESIA WEATHER BUREAU.

APRIL, 1932.

**Pressure.**—The barometric pressure was generally slightly below normal, except at Bulawayo.

The semi-permanent anticyclone was established at the beginning of the month and maintained its position, being reinforced on the 7th by a high which appeared on the south coast; it was broken up on the 19th by a low on the south coast, but reappeared on the 22nd and remained until the 25th. A weak high appeared on the 27th. On the 29th a high appeared on the south coast and moved in a northerly direction.

Small lows passed along the south coast in the early part of the month, but were too weak to affect local conditions. On the 18th a low appeared on the south coast, and on the 19th and 20th was off the south-east coast and very deep. A second low appeared on the south-west Cape on the 24th, and was off the south coast on the 25th.

**Temperatures.**—The maximum temperatures were generally low and the minimum temperatures high, leaving the mean temperature about normal.

**Rain.**—Showers were recorded every day during the month. Light isolated showers occurred from the 1st to the 14th; on the 15th and 16th showers were numerous in the north and west, and continued in the north on the 17th. Isolated showers fell on the 18th and 20th. Scattered showers fell on the 21st, becoming numerous from the 22nd to the 25th and fairly general on the 26th. Light showers continued to fall up to the end of the month.

**Seasonal Rainfall.**—The rainfall for the month of April was approximately 1.8 inches, making the seasonal total 28.9 inches, or 1.5 inches above normal. These figures are approximate, as a number of returns are still outstanding.

APRIL, 1932.

| Station. | Pressure Millibars, 8.30 a.m. | | Temperature in Stevenson Screen ° F. | | | | | | | | Rel. Hum. | Dew Point | Cloud Amt. | Precipitation. | | | Altitude (Feet). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Absolute. | | Mean. | | | | | | | | | | | | |
| | Mean. | Normal. | Max. | Min. | Max. | Min. | ½ Max Min. | Normal. | Dry Bulb. | Wet Bulb. | % | F. | 0-10 | Ins. | Normal. | No. of Days. | |
| Bulawayo ... | 871.0 | 870.3 | 83 | 44 | 75.3 | 54.6 | 65.1 | 65.9 | 64.0 | 58.9 | 74 | 55 | 5.5 | 1.00 | 0.6 | 8 | 4,436 |
| Gwelo ... ... | 864.6 | ... | 81 | 45 | 74.8 | 55.3 | 65.0 | 65.5 | 63.4 | 59.4 | 79 | 57 | 6.8 | 1.14 | 0.7 | 8 | 4,632 |
| Riverbank ... | ... | ... | 86 | 47 | 80.1 | 55.8 | 68.0 | 68.0 | 65.4 | 60.0 | 73 | 57 | ... | 2.13 | 0.6 | 8 | 4,100 |
| Essexvale ... | ... | ... | 93 | 47 | 82.2 | 56.5 | 69.3 | 67.4 | 63.3 | 59.7 | 81 | 57 | .. | 1.65 | 0.5 | 5 | 3,828 |
| Gwanda ... | 908.9 | ... | 89 | 50 | 77.9 | 57.2 | 67.5 | ... | 68.3 | 62.2 | 71 | 58 | 3.9 | 1.20 | 0.5 | 5 | 3,235 |
| Mazunga ... | 950.8 | 951.1 | 98 | 49 | 87.0 | 58.9 | 72.9 | 72.2 | 73.2 | 64.3 | 61 | 59 | 5.4 | 0.17 | 0.6 | 2 | 1,970 |
| Nuanetsi ... | ... | ... | 97 | 49 | 85.7 | 59.5 | 72.6 | .. | 70.8 | 65.0 | 73 | 62 | 5.9 | 0.28 | 0.6 | 6 | 1,630 |
| Between Rivers | ... | ... | 87 | 49 | 81.4 | 56.7 | 69.0 | ... | 65.3 | 61.7 | 82 | 60 | 5.1 | 1.48 | 1.7 | 7 | 3,970 |
| Enkeldoorn ... | ... | ... | 80 | 45 | 74.4 | 54.8 | 64.6 | 64.6 | 63.3 | 59.2 | 77 | 56 | 5.6 | 2.00 | 0.7 | 9 | 4,720 |
| Gatooma ... | ... | ... | 83 | 46 | 79.6 | 56.5 | 68.0 | 69.2 | 67.0 | 61.6 | 74 | 58 | 4.1 | 1.97 | 0.8 | 8 | 3,850 |
| Miami ... ... | ... | ... | 82 | 55 | 78.5 | 58.5 | 68.5 | ... | 66.0 | 62.0 | 80 | 60 | 4.9 | 1.71 | 1.3 | 11 | 4,090 |
| Salisbury ... | 856.8 | 856.9 | 81 | 46 | 76.5 | 55.0 | 65.8 | 65.5 | 65.3 | 58.8 | 68 | 55 | 5.0 | 2.77 | 1.0 | 13 | 4,890 |
| Sinoia, Citrus ... | ... | ... | 83 | 52 | 79.6 | 57.5 | 68.5 | ... | 65.5 | 61.5 | 80 | 59 | ... | 1.35 | 1.6 | 7 | 3,830 |
| Sipolilo... ... | ... | ... | 84 | 53 | 77.2 | 58.9 | 68.0 | ... | 68.2 | 61.5 | 69 | 58 | 4.1 | 1.74 | 1.3 | 9 | 3,900 |
| Mtoko ... ... | ... | ... | 83 | 51 | 76.5 | 57.6 | 67.0 | ... | 66.5 | 60.9 | 73 | 58 | 4.1 | 1.69 | 0.5 | 6 | 4,210 |
| Shamva ... | ... | ... | 86 | 52 | 81.0 | 59.4 | 70.2 | ... | 69.3 | 64.2 | 76 | 62 | 3.8 | 1.53 | 1.3 | 5 | 3,170 |
| Angus Ranch ... | ... | ... | 91 | 53 | 81.6 | 61.9 | 71.8 | 70.4 | 70.4 | 65.3 | 76 | 63 | ... | 0.13 | 1.2 | 4 | 2,300 |
| Craigendoran ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3,430 |
| New Year's Gift | ... | ... | 89 | 56 | 78.8 | 59.0 | 68.9 | ... | 66.4 | 61.9 | 78 | 59 | ... | 1.24 | 0.7 | 10 | 2,700 |
| Nyamasanga ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5,080 |
| Riverdene North | ... | ... | 88 | 43 | 79.2 | 54.2 | 66.7 | ... | 63.9 | 60.6 | 83 | 59 | ... | 0.55 | 0.7 | 9 | 3,700 |
| Stapleford ... | ... | ... | 76 | 40 | 67.2 | 51.5 | 59.3 | ... | 60.3 | 57.4 | 83 | 55 | 6.2 | 5.88 | 3.0 | 20 | 5,450 |
| Umtali ... ... | 895.0 | 894.9 | 86 | 50 | 72.9 | 58.0 | 65.5 | 66.2 | 67.7 | 62.4 | 74 | 59 | 5.6 | 1.81 | 1.0 | 9 | 3,677 |
| Victoria ... | 898.1 | 898.3 | 85 | 46 | 76.8 | 55.6 | 66.2 | 65.0 | 66.7 | 61.4 | 74 | 58 | 4.2 | 0.58 | 0.6 | 6 | 3,570 |
| Manchester ... | ... | ... | 76 | 48 | 68.4 | 53.9 | 61.1 | ... | 56.5 | 55.6 | 94 | 54 | ... | 4.51 | ... | 16 | ... |
| Melsetter ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5,060 |
| Mount Selinda | ... | ... | 86 | 52 | 72.8 | 58.1 | 65.4 | ... | 64.4 | 61.2 | 84 | 59 | 5.7 | 1.64 | 3.4 | 9 | 3,520 |

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